TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME LIV

HALL OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

LOGAN SQUARE

1928

Digitized by the Internet Archive
in 2025

https://archive.org/details/transactions-of-the-american-entomological-society_1928-1929_54

LIST OF PAPERS

BRADLEY (J. CHESTER)

A Revision of the New World Species of Trielis a Subgenus of Camposmeris (Hymenoptera: Scoliidae) . 195

(Issued, October 3, 1928)

BROWN (CLAUDEOUS J. D.)

A Morphological and Systematical Study of Utah Asilidae (Diptera) 295

(Issued, February 13, 1929)

FLETCHER (FRANK C.)

The Cornell University Entomological Expedition to South America, 1919-1920. Scientific Results No. 4. Pselaphidae (Coleoptera) 69

(Issued, May 16, 1928)

GENTNER (L. G.)

Contributions to Our Knowledge of North American Halticinae. I. Notes with Descriptions of New Species (Coleoptera: Chrysomelidae) 57

(Issued, May 16, 1928)

HAIMBACH (FRANK)

A List of the Species and Descriptions of New Forms of the American Genus Zale and a New Form of Safia (Lepidoptera: Noctuidae) 215

(Issued, October 3, 1928)

HEBARD (MORGAN)

The Group Luzarae of the Subfamily Phalangopsinae (Orthoptera: Gryllidae) 1

(Issued, April 30, 1928)

Studies in the Dermaptera and Orthoptera of Colombia. Fifth Paper. Orthopterous Family Gryllidae 79

(Issued, June 12, 1928)

Studies in the Gryllidae of Panama (Orthoptera) . . 233

(Issued, November 12, 1928)

MITCHELL (THEODORE BERTIS)
Sex Anomalies in the Genus Magachile, with Descriptions of New Species (Hymenoptera: Megachilidae) 321
(Issued, March 1, 1929)

REHN (JAMES A. G.)
New or Little Known Neotropical Blattidae (Orthoptera) 125
(Issued, July 18, 1928)

LIST OF MEMBERS OF THE AMERICAN ENTOMOLOGICAL SOCIETY

RESIDENT MEMBERS

(J) indicate Junior Resident Members

ABBOTT, WILLIAM L., Northeast, Maryland.

ALLEN, HARRY W., Japanese Beetle Laboratory, Moorestown, New Jersey.

BALLOU, CHARLES H., 44 East Central Avenue, Moorestown, New Jersey.

BAYLIS, ERNEST, 5011 Saul Street, Frankford, Philadelphia, Pennsylvania.

BRADLEY, J. CHESTER, Department of Entomology, Cornell University, Ithaca, New York.

BURRELL, ROBERT W., Japanese Beetle Laboratory, Moorestown, New Jersey.

CADBURY, JOHN WARDER, 3RD., 12 High Street, Moorestown, New Jersey. (J).

CALVERT, PHILIP P., Box 14, Cheyney, Pennsylvania.

CARY, MARGARET M., 1 Lehman Lane, Germantown, Philadelphia, Pennsylvania.

CHAPMAN, WILLIAM W., 134 South Second Street, Philadelphia, Pennsylvania.

CIENKOWSKI, EDMUND H., 6803 Bustleton Avenue, Philadelphia, Pennsylvania.

COXEY, W. JUDSON, 428 Linden Street, Camden, New Jersey.

CRESSON, EZRA T. JR., 11 Amherst Avenue, Swarthmore, Pennsylvania.

CULBERTSON, JAMES T., 137 Hilldale Road, Lansdowne, Pennsylvania.

DARLINGTON, EMLEN P., New Lisbon, New Jersey.

DAVIS, WILLIAM T., 146 Stuyvesant Place, New Brighton, S. I., New York.

EHINGER, WILLIAM J., 1327 North Fourth Street, Philadelphia Pennsylvania.

ENBURG, JOHN M., 5431 Catharine Street, Philadelphia, Pennsylvania.

Fenninger, Carl W., 1632 Chestnut Street, Philadelphia, Pennsylvania.

Fox, Henry, Japanese Beetle Laboratory, Moorestown, New Jersey.

Frost, Charles W., 2224 Delancy Street, Philadelphia, Pennsylvania.

Greene, Charles T., Box 182, College Park, Maryland

Gunder, Jeane D., 849 Linda Vista Avenue, Pasadena, California.

Haimbach, Frank, Box 15, Langhorne, Pennsylvania.

Harley, Alan G., 811 Noble Street, Norristown, Pennsylvania.

Hebard, Morgan, Chestnut Hill, Philadelphia, Pennsylvania.

Hodge, Charles, Jr., 4636 Walnut Street, Philadelphia, Pennsylvania.

Holloway, James K., Japanese Beetle Laboratory, Moorestown, New Jersey.

Horning, Herman, Public Museum & Art Gallery, Reading, Pennsylvania.

Ilg, Carl, Entomological Laboratory, Bleeker Place, New Brunswick, New Jersey.

Jones, Frank M., 2000 Riverview Avenue, Wilmington, Delaware.

Kisliuk, Max, Jr., 134 South Second Street, Philadelphia, Pennsylvania.

Laurent, Philip, 31 East Mt. Airy Avenue, Philadelphia, Pennsylvania.

Liebeck, Charles, 1633 Columbia Avenue, Philadelphia, Pennsylvania.

Lutz, John C., 6623 Lansdowne Avenue, Philadelphia, Pennsylvania.

McClung, Clarence E., 417 Harvard Avenue, Swarthmore, Pennsylvania.

Marx, Edward J. F., St. Martin's Road, Colwick, Merchantville, New Jersey.

Napier, Arthur H., 503 East Willow Grove Avenue, Chestnut Hill, Philadelphia, Pennsylvania.

Pate, Vernon S. L., 5703 North Sixth Street, Philadelphia, Pennsylvania.

Rehn, James A. G., 6026 Walton Avenue, Philadelphia, Pennsylvania.

Rehn, J. William H., 6026 Walton Avenue, Philadelphia, Pennsylvania. (J).

Richter, Frederic T., 5427 Wayne Avenue, Philadelphia, Pennsylvania. (J).

Schmieder, Rudolph G., 4351 Pechin Street, Philadelphia, Pennsylvania.

Sim, Robert J., R. F. D. 1, Riverton, New Jersey.

Smith, Floyd F., Department of Entomology, Ohio State University, Columbus, Ohio.

Thompson, Eastburn H. Jr., 5016 Schuyler Street, Germantown, Philadelphia, Pennsylvania.

Titherington, Robert J., 6317 Norwood Street, Germantown, Philadelphia, Pennsylvania.

Wenzel, Harry A., 1912 North 61st Street, Philadelphia, Pennsylvania.

West, John W., 4507 North Fifth Street, Philadelphia, Pennsylvania.

Williams, Roswell C., Jr., 4537 Pine Street, Philadelphia, Pennsylvania.

Winecoff, Thomas E., 2112 North Washington Street, Scranton, Pennsylvania.

CORRESPONDING MEMBERS

Aldrich, James M., U. S. National Museum, Washington, D. C.

Austen, Ernest E., British Museum of Natural History, London, England.

Banks, Nathan, Museum of Comparative Zoology, Cambridge, Massachusetts.

Becker, Theodor, Leignitz, Germany.

Bethune-Baker, George T., 9 Eversfield-road, Eastbourne, England.

Bethune, Charles J., Port Hope, Canada.

Blaisdell, Frank E., 1520 Lake Street, San Francisco, California.

Blatchley, William S., Box 374, Dunedin, Florida.

Bruner, Lawrence, 3033 Deakin Street, Berkeley, California.

Carpenter, George H., The Manchester Museum, The University of Manchester, England.

Chopard, Lucien, 22 Square, Arago, Paris 13e, France.

Cockerell, Theodore D. A., University of Colorado, Boulder, Colorado.

Comstock, John H., 123 Roberts Place, Ithaca, New York.

Davis, William M., University Museum, Cambridge, Massachusetts.

Escherich, K., Universität, Prinzenstr. 26, München, Germany.

Fall, Henry C., Tyngsboro, Massachusetts.

Felt, Ephraim P., Stamford, Connecticut.

Forbes, Stephen A., State Museum, Urbana, Illinois.

Forel, August, Yvorne, Ct. de Vaud, Switzerland.

French, George H., Herrin, Illinois.

Gibson, Arthur, Entomological Branch, Department of Agriculture, Ottawa, Canada.

Hampson, George F., Thurnham Court, Maidstone, Kent, England.

Handlirsch, Anton, Naturhistorische Museum, Wien, Austria.

Hendel, Friedrich, Darwingasse 30, Wien II, Austria.

Henshaw, Samuel, Museum of Comparative Zoology, Cambridge, Massachusetts.

Horn, Walther, Deutsche entomologische Institut, Berlin-Dahlem, Germany.

Horvath, Geza v., Section Zoology, Musee National Hongrois, Budapest, Hungary.

Howard, L. O., U. S. Department Agriculture, Washington, D. C.

Jordan, Karl, Zoological Museum, Tring, Herts, England.

Kellogg, Vernon L., National Research Council, 1701 Massachusetts Avenue, Washington, D. C.

Kolbe, H. Josef, Steinäckerstr. 12, Berlin-Lichterfelde W., Germany.

Lameere, Auguste, 74 rue Defacqz, Bruxelles, Belgium.

Leng, Charles W., Public Museum, Staten Island, New York.

Marchal, Paul, 45 rue de Verrièrese, Antony (Siene), France.

Marlatt, Charles L., U. S. Department of Agriculture, Washington, D. C.

Mengel, Levi W., Public Museum & Art Gallery, Reading, Pennsylvania.

Morse, Albert P., Peabody Museum, Salem, Massachusetts.

Nason, William A., Algonquin, Illinois.

Needham, James G., 6 Thurston Avenue, Ithaca, New York.

Nuttall, George H. F., 3 Cranmer Road, Cambridge, England.

Osborn, Herbert, State University, Columbus, Ohio.

Poulton, Edward B., Wykeham House, Banbury-road, Oxford, England.

REVERDIN, JACQUES, Rive de Pregny, Route de Lausanne, Genève, Switzerland.

RILEY, NORMAN D., British Museum of Natural History, South Kensington, England.

RIS, FRIEDRICH, Rheinau, Canton Zurich, Switzerland.

ROTHSCHILD, WALTER, Zoological Museum, Tring, Herts, England.

SCHAUS, WILLIAM, U. S. National Museum, Washington, D. C.

SCHOUTEDEN, HENRI, 5 rue St. Michel, Woluwe, St. Pierre, Bruxelles, Belgium.

SEVERIN, G., 31 rue Vautier, Bruxelles, Belgium.

SILVESTRI, FILIPPO, Laboratorio di Zoologia, R. Scuola, Sup. Agricoltura, Portici, Italy.

SJOSTEDT, BROV Y., Riksmuseet, Stockholm 50, Sweden.

TILLYARD R. J., Cawthon Institute, Nelson, New Zealand.

UVAROV, B., British Museum of Natural History, South Kensington, London, England.

VAN DUZEE, EDWARD P., California Academy Science, San Francisco, California.

VAN DYKE, EDWIN C., Agriculture Hall, University of Berkeley, California.

WALKER, EDWARD M., University of Toronto, Toronto, Ontario, Canada.

WASMANN, ERICH, Ignatius Kolleg, Valkenburg (L.), Holland.

WHEELER, WILLIAM M., Bussey Institute, Forest Hills, Boston, Massachusetts.

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME LIV

THE GROUP LUZARAE OF THE SUBFAMILY PHALANGOPSINAE

(ORTHOPTERA, GRYLLIDAE)

BY MORGAN HEBARD

In studying the Gryllidae of Panama and Columbia we have found first that all of the genera, except *Oecanthus* and *Neoxabea*, referred by Saussure and subsequent authors to the Oecanthinae were so widely separated from *Oecanthus* Latreille that separation as one or more distinct subfamilies is imperative. The subfamily at present under consideration includes the same genera referred by Saussure in 1878 to his "Légion Phalangopsites" and by Kirby in his 1906 Catalogue to the "Oecanthinae B" and we recognize it as the Phalangopsinae. This assemblage was also separated as the Phalangopsitidae by Bruner in 1916. The subfamily is readily separated from the Oecanthinae by the vertical head, the cephalic tibiae which are not enlarged proximad, the robust body and the mirror of the male tegmina, when such is developed, divided by two or more veins (except in *Palpigera* here described). In addition, except for the aberrant Cuban genus *Cophus* Saussure, the pronotum is short, with ventral margin of lateral lobes ascending caudad more than cephalad.

Secondly it became evident, from examination of other unstudied series from tropical America before us, that many species and a large number of genera, yet undescribed, were represented. In sorting out the species which ran to *Diplacusta*

Saussure (a synonym of *Lerneca* Walker) and *Luzara* Walker, such proved to be particularly true and it has therefore seemed advisable to consider these genera and species separately, as, taken up one by one in faunistic papers, by no means as satisfactory comparisons could be made.

A series of two hundred and twenty-nine specimens examined includes eighteen genera and thirty-three species, of which fifteen genera and twenty-three species are new. These are treated here (one other species probably belonging to the Group being discussed), all sharing the following characters, in addition to those noted above for the subfamily. Body rather compressed than depressed. Fastigium broad or moderately broad, declivent, curving into the face so that the projection thus formed is short and obtuse.[1] Ocelli with distance between the lateral equal or slightly greater than that from one of these to the median.[1] Pronotum with ventro-cephalic angle broadly rounded, its ventral margin thence gradually ascendant caudad to the more broadly rounded ventro-caudal angle. Limbs not very elongate and slender. Caudal tibiae with three pairs of spurs, the three external very short with the median their longest, the dorso-internal very elongate but only surpassing the median by a short distance. Caudal metatarsi with dorsal surface armed with two rows of minute teeth.

A1. Tegmina well developed,[2] their structure delicate. (Size small. Tegminal venation conspicuous, the dorsal field deplanate in the male sex. Maxillary palpi moderately elongate.)

B1. Lateral fields of male tegmina specialized, the mediastine vein sending numerous oblique branches to the costal margin.

C1. Projection formed by fastigium and face very bluntly rounded. Cephalic tibiae with auditory foramen on cephalic face only. Male tegmina less ample, dorsal field not widening caudad, speculum rounded cephalad, its two veins recurving sharply before their dextral apices, apical area without

[1] Except in some species of *Amusodes* and in *Megalamusus*, which genera are aberrant, showing distinct divergence in these characters toward the succeeding group, the Heterogrylli.

[2] The female sex is not known for *Lernecella* and several species of *Lerneca*.

venation; lateral fields decidedly less retreating and almost perpendicular, (the humeral and mediastine veins approximate). Male subgenital plate not longitudinally channeled, its apex truncate. (♂ length of tegmen 5.5, length of caudal femur 7.2 to 7.7 mm.). Trinidad.

Lernecella trinitatis n. gen. and sp.

CC1. Projection formed by fastigium and face less bluntly rounded. Cephalic tibiae with auditory foramina on both faces. (Both sexes with fully developed tegmina.) Male tegmina more ample, dorsal field widening caudad, speculum angulate cephalad, its two veins straight to near their dextral apices, apical area with radiating veinlets[3]; lateral fields strongly retreating. Male subgenital plate longitudinally feebly to decidedly channeled, its apex bilobate.

Lerneca Walker

D1. Face flattened. Humeral and mediastine veins of male tegmina approximate.

E1. Palpi dark. Face and lateral lobes of pronotum not solidly and strikingly black.

F1. Pronotum with disk yellowish; lateral lobes blackish, bordered ventrad with yellowish. Limbs annulate. (wingless ♂, length of tegmen 10, length of caudal femur 9 mm.) Brazil.....*Lerneca fuscipennis* (Saussure)[4]

FF1. Pronotum with disk reddish brown, heavily overlaid with dark brown; lateral lobes black. Limbs blackish brown. (♂ length of tegmina (wingless) 7.8, (winged) 8.8, length of caudal femur 6.8 to 7.2 mm.). Western Brazil, eastern Peru and northeastern Bolivia. *Lerneca funebris* new species

EE1. Palpi with last two joints white. Face, including mouthparts, solidly and strikingly black. (Head, disk of pronotum and tegmina light brown with a grayish tendency. Limbs annulate. Length of tegmina (wingless) ♂ 8.7 to 9.8, ♀ 6.4 to 8.2, (winged) ♀ 10.8 to 11; length of caudal femur ♂ 8 to 9.8, ♀ 7.8 to 9.4; length of ovipositor 6.7 to 8 mm.) Panama, Trinidad, Guiana, Brazil and Bolivia.

Lerneca varipes (Walker)

[3] Except in *inalata* (Saussure), which species may very possibly be a member of a distinct genus.

[4] We have no material of this species, this data being taken from Saussure's description.

DD1. Face convex. Humeral and mediastine veins of male tegmina separated. (Palpi with last two joints whitish. ♂ length of tegmina (wingless) 9, length of caudal femur 7 mm.) Surinam.....*Lerneca inalata* (Saussure)[5]

BB1. Lateral fields of tegmina with simple venation, the mediastine vein not sending oblique veins to the costal margin. (Cephalic tibiae with auditory foramen on cephalic face only. Male tegmina with dorsal contour and venation much as in *Lernecella,* but with very narrow apical area showing radiating veinlets. Palpi with distal joints white. Tegmina uniform dark brown, with dorsal field of male having a very narrow pale margin on all sides. ♂ length of tegmen 6, length of caudal femur 7.3 mm.) Cordova, Mexico.
Prosthacusta circumcincta (Scudder)[6]

AA1. Tegmina moderately to greatly reduced or absent, when present with structure chitinous, often corneous. (Tegmina with venation of dorsal field weak or obsolete; lateral fields with simple venation, the mediastine vein not sending oblique veins to the costal margin.)

B2. Cephalic tibiae with auditory foramina on one or both faces.

C2. Tegmina with lateral fields having each two, unbranched, longitudinal veins,

D2. Cephalic tibiae with auditory foramen on cephalic face only.

E2. Male tegmina overlapping in such a way that the dextral dorsal field almost wholly covers the sinistral, venation there obsolete, but with a distinct transverse depression showing the "archet"[7]; dorsal field flattened and angulation between it and the vertical lateral fields distinct. Limbs shorter, caudal femora decidedly robust, general appearance Grylloid. Entire dorsal surface strongly hirsute, the tegmina not at all glabrous. (Palpi moderately elongate, the last two joints strikingly white. Ovipositor of medium length, its apex deeper than wide. General coloration blackish, the abdomen dorsad and caudal femora to near apices dark brown, the dorsal field of the tegmina deep ferruginous. Antennae unicolorous[8]. Size medium.).....*Gryllosoma* new genus

[5] As noted above, this species, material of which we have not seen, may represent a distinct genus.

[6] Saussure's color figure of the male is excellent; Miss. Sci. Mexique, Rech. Zool., VI, pl. 7, Fig. 18, (1874).

[7] This is Saussure's term for the transverse portion of the anal vein.

[8] In the more recessively colored immatures, however, short pale antennal annuli are weakly indicated.

F2. General structure very robust for the group, limbs very short. Dorsal surface very strongly hirsute. Palpi with penultimate joint considerably thickened, ultimate joint with apical oblique truncation occupying slightly over one-third its length. Length of tegmen ♂ 3.2 to 3.3, ♀ 3 to 3.2; length of caudal femur ♂ 9 to 9.2, ♀ 9.4 to 10.8; length of ovipositor 7.2 to 7.7 mm. Panama.—*Gryllosoma esau* new species

FF2. General structure appreciably less robust, limbs short. Dorsal surface strongly hirsute. Palpi with penultimate joint moderately thickened, ultimate joint with oblique truncation occupying approximately one-quarter its length. ♀ length of tegmen 2.8, length of caudal femur 9.4, length of ovipositor 7 mm. Colombian Chocó.....*Gryllosoma choco* new species

EE2. Male tegmina overlapping strongly but with dextral dorsal field covering only sligthly more than half the sinistral, dorsal exposed fields with venation obsolete, smooth, convex and curving into the lateral fields without angulation. Limbs more elongate, medium for the group, general appearance Amusinoid. Dorsal surface moderately or strongly polished, weakly or not at all hirsute. (Limb annulation weak.)[9]

F3. Size medium, form more robust. Palpi elongate. Female tegmina attingent or slightly overlapping. Ovipositor with apex deeper than wide. Entire dorsal surface strongly polished, not at all hirsute except caudad on abdomen. Antennae conspicuously annulate. General coloration very dark, tegmina uniform blackish brown. Length of tegmina ♂ 2.6 to 3.2, ♀ 1.8 to 3.3; length of caudal femur ♂ 9.7 to 10.8, ♀ 10.3 to 12.8; length of ovipositor 10.3 to 12.8 mm. Mountains of Costa Rica.....*Rehniella glaphyra* n. gen. and sp.

FF3. Size small, form less robust. Palpi very elongate. Female tegmina represented by small lateral pads. Ovipositor with apex wider than deep. Entire dorsal surface moderately polished, weakly hirsute. Antennae not annulate. General coloration light brown with a darker lateral band on pronotum and tegmina, the latter with broad distal margin in male and vestigial dorsal field in female buffy. Length of tegmina ♂ 2.7, ♀ 1.1 to 1.2; length of caudal femur ♂ 7.7, ♀ 7.8 to 8.8; length of ovipositor 6 to 7 mm. Eastern lowlands of Costa Rica and Panama...*Prosthama tessellata* n. gen. and sp.

[9] But conspicuous in immature idividuals of *Rehniella glaphyra*.

DD2. Cephalic tibiae with auditory foramina on both faces. (Tegmina suggesting *Gryllosoma* but less strongly hirsute, and in male with "archet" even more distinctly sulcate and dorsal field broadly and evenly rounded distad. Limbs and palpi of medium length. Ovipositor with apex wider than deep. General coloration (usually light) reddish brown, tegmina and sometimes lateral lobes of pronotum darker, the former margined very narrowly laterad and broadly distad with buff, this expanding on each shoulder proximad. Limbs light reddish brown, almost immaculate. Antennae brown with slightly paler annuli. Size below medium. Length of tegmen ♂ 3.2, ♀ 2.4 to 2.8; length of caudal femur ♂ 7.2, ♀ 9.6 to 10; length of ovipositor 7.8 to 8.1. Sierra San Lorenzo, Colombia.....*Tairona pulchella* n. gen. and sp.

CC2. Tegmina with lateral fields having each more than two longitudinal viens, (some of which branch in all males known to us except *Amusina*).

D3. Cephalic tibiae with auditory foramen on cephalic face only. Palpi with last two joints white. (Male tegmina overlapping, the dextral dorsal field almost completely covering the sinistral. Limbs moderately short for the group. Dorsal surface shining, abdomen alone very feebly hirsute.

E3. Palpi simple. Male tegmina with entire shining dorsal surface weakly convex, with no deflexed distal marginal portion; lateral fields not flaring outward dorsad, with three longitudinal veins. (Size slightly below medium.)

F4. Palpi moderately elongate. Male tegmina without trace of venation on hairless dorsal surface, that sharply defined from the vertical lateral fields in which the lowest longitudinal vein is forked. Male subgenital plate convex to its truncate apex. Antennae unicolorous. Coloration very dark brown, with tegmina and caudal femora to apices light brown, the former with a buffy distal margin. (♂ length of tegmen 4.7, length of caudal femur 9.1 mm.) Nicaragua.
Niquirana polita[10] n. gen. and sp.

FF4. Palpi very elongate. Male tegmina with impressed archet and mere traces of other venation in microscopically impresso-punctulate[11] dorsal surface, which rounds evenly

[10] From the description of the Mexican *Amusus mexicanus* Saussure, it is evident that the species does not belong to *Luzara* (of which *Amusus* is a synonym). It is apparently a member of a genus very close to the genera *Niquirana* and *Amusina*, but has four veins in the tegminal lateral fields and dark palpi.

[11] The bases of exceedingly minute hairs, also present in the lateral fields.

into the weakly convex lateral fields in which none of the veins fork [12]. (Female tegmina minute, lobiform, lateral, their glabrous surface without veins.) Male subgenital plate bilobate distad, with a broad and deep medio-longitudinal sulcus in distal half. Antennae feebly annulate. (Ovipositor considerably shorter than caudal femur, with apex deeper than wide.) Coloration dark brown, with tegmina and limbs slightly paler, the former without a pale distal margin. Length of tegmen ♂ 3.8, ♀ .7; length of caudal femur ♂ ——, ♀ 11.1; length of ovipositor 7.8 mm. Ecuador.
Amusina kraussi (Griffini)

EE3. Palpi with penultimate and ultimate joints expanded and flattened. Male tegmina with entire dorsal surface flat, caudal margin narrowly deflexed and irregularly but broadly convex, venation there conspicuous but irregular; lateral fields nearly vertical but flaring outward narrowly dorsad; (female tegmina overlapping with numerous decided longitudinal veins in dorsal field and four similar veins in lateral field [13]. Antennae very weakly annulate. Limbs not annulate. General coloration blackish and reddish brown.)
Palpigera new genus

F5. Palpi less expanded, the last joint about two-fifths as wide as long at its widest point, the dorsal margin concave (this broad in male, broader, very weak in female).

G1. Size medium. Male supra-anal plate with disto-lateral angles sharply rounded at slightly over ninety degrees and showing no production whatever. Head and cephalic and median limbs blackish. Tegmina ochraceous tawny with lateral fields only darkened at their apices. Caudal femora ochraceous tawny deepening to tawny distad. Santa Anna da Chapada, Brazil.....*Palpigera fratercula* new species

GG1. Size large. Male supra-anal plate with disto-lateral angles produced as straight, divergent, rounded fingers which are longer than wide. Color less contrasting, the tegmina and caudal femora darker. Eastern Bolivian Chaco and Corumba, Brazil.....*Palpigera boliviana* (Bruner)

[12] The humeral is similar to the mediastine and two free veins in contour and paleness on both tegmina, the discoidal similar on the sinistral tegmen but much weaker and not pale on the dextral tegmen.

[13] The female sex of *P. fratercula* is not known.

FF5. Palpi very greatly expanded, the last joint nearly half as wide as long at its widest point, the dorsal margin broadly convex to a brief and weakly concave apical portion, the convexity and distal concavity very weak in female. (Size and coloration as in *boliviana*. Male supra-anal plate with distolateral angles roundly lobate, projecting but not as long as wide. Western Bolivian Chaco.
Palpigera borellii[14] (Giglio-Tos)

DD3. Cephalic tibiae with auditory foramina on both faces. Palpi dark. (Female tegmina overlapping.)

E4. Impressions of pronotal disk feeble, inconspicuous. Antennae annulate[15]. Size small to large.

F6. Form more robust with shorter limbs. Occiput uniformly of general coloration. (Fastigium normal for Group. Male subgenital plate with a decided longitudinal distal sulcus.)

G2. Tegminal dorsal field with venation reduced, delicate but distinct; males with lateral fields slanting inward ventrad and flaring narrowly dorsad, the mediastine vein often branched and sending short oblique veinlets to the costal margin distad.
Luzarida new genus

II1. Pronotum and limbs proportionately shorter. Tegmina of female[16] less reduced. Ovipositor moderately elongate.

I1. Male tegmina with both dorsal and lateral fields narrower in proportion to their length. Lateral ocelli slightly nearer each other than they are to the median ocellus. Antennae buffy with short irregular dark brown annuli. General coloration light yellowish brown, but blackish as follows; palpi, genae, pronotal lateral lobes, cephalic and median femora, flexor surface of caudal tibiae and other tibiae except for pale annuli. (Female tegmina with venation of dorsal field regular, lateral field with five longitudinal veins. Length of tegmen ♂ 10, ♀ 8; greatest width of tegminal dorsal fields ♂ 7; length of caudal femur ♂ 13.7, ♀ 15.8; length of ovipositor 12.7 mm.) Magdalena, Colombia.
Luzarida annuliger new species

I1. Male tegmina with both dorsal and lateral fields broader in proportion to their length. Ocelli forming an equilateral triangle. Antennae blackish with short irregular buffy annuli.

[14] Originally referred to *Ectecous* Saussure, subsequently *borellii* has been placed in *Prosthacusta* Saussure.

[15] The only specimen known of *Amusodes albifrons* lacks antennae.

[16] This sex of *Luzarida pulla* is not known.

General coloration blackish, occiput and pronotal disk, particularly laterad, flecked with buffy. (Male tegmina with lateral margins of dorsal field buffy. ♂ length of tegmen 9.6, greatest width of tegminal dorsal fields 7.4, length of caudal femur 12.2 mm.) Boyaca, Colombia.

Luzarida pulla new species

HH1. Pronotum and limbs proportionately longer. Tegmina of female more reduced, (the longitudinal veins of the dorsal fields apparently less regular and more liable to fork, those of the lateral fields four in number). Ovipositor short. (Coloration much as in *annuliger* but slightly more reddish, occiput with longitudinal dark markings; cephalic femora pale with apices and a weak pregenicular annulus darker, caudal femora pale in proximal portion of dorso-external section and caudal tibiae dark with a faint proximal pale annulus. ♀ length of tegmen 6.2, length of caudal femur 16.7, length of ovipositor 9.2 mm.) Trinidad.

Luzarida gracilior new species

GG2. Tegminal dorsal field with venation greatly reduced, almost obliterated; males with lateral fields almost perpendicular, flaring scarcely at all dorsad, the mediastine vein usually unbranched and never sending short oblique veinlets to the costal margin distad. (Ocelli forming an equilateral triangle. Antennae dark with short buffy annuli. General coloration dark brown.) ..... *Luzara* Walker

H2. Size medium. Lateral fields of tegmina normally [17] with four veins. Length of tegmen ♂ 6.4 to 6.9, ♀ 4.2 to 5.7; length of caudal femur ♂ 10 to 11, ♀ 11.3 to 13.9; length of ovipositor 9.3 to 10.7 mm. Magdalena, Colombia.

Luzara minor new species

HH2. Size large. Lateral fields of tegmina normally [18] with five veins. Length of tegmen ♂ 9.7, ♀ 5.3 to 8.2; length of caudal femur ♂ 16.2, ♀ 14.2 to 16.3; length of ovipositor 12.5 to 13.8 mm. Panama and Magdalena, Colombia.

Luzara rufipennis Walker

[17] In one male on one tegmen there are three veins one of which forks, in another male on one tegmen there are four veins one of which forks.

[18] The males before us have four and one forking, five, five and one forking or six such veins. The type in the British Museum has six veins on one side and four on the other, one of which branches, while the male in the Geneva Museum has five and four, one on each side branching.

FF6. Form slender with very elongate limbs for the group. Occiput with pale stripes or uniformly contrastingly pale. *Amusodes* new genus

G3. Occiput and fastigium uniformly contrastingly pale. Fastigium normal. (Lateral ocelli slightly more widely separated from each other than from the median ocellus. Size small. Pronotum uniform very dark brown. Male tegmina with dorsal surface very feebly convex and showing no trace of veins, smooth and shining; lateral fields vertical with five unbranched longitudinal veins. ♂ length of tegmen 4.8, greatest width of tegmen 4 mm.) British Guiana. *Amusodes albifrons* new species

GG3. Occiput dark with pale longitudinal stripes. Fastigium slightly less declivent and more rostrate than in the preceding species. (Lateral fields of female [19] tegmina with three or four longitudinal veins [20].)

H3. Fastigium weakly rostrate, the lateral ocelli not closer to each other than to the median ocellus. Ovipositor shorter in proportion to caudal femur with apex wider than deep. Sides of pronotum and tegmina not darker than elsewhere.

I2. Occipital pale stripes and limb annuli very weak and inconspicuous. Pronotum unicolorous. Female tegmina decidedly reduced. Size decidedly larger. ♀ length of tegmen 3.8, length of caudal femur 18.3, length of ovipositor 12.2 mm. Costa Rica.....*Amusodes estrellae* new species

II2. Occipital pale stripes and limb annuli decided and conspicuous. Pronotum with cephalic portion or all of lateral lobes pale. Female tegmina slightly less reduced. Size smaller. ♀ length of tegmen 3.7 to 4, length of caudal femur 14.8 to 16, length of ovipositor 11.3 to 12 mm. Panama and Colombian Chocó.....*Amusodes festae* (Giglio-Tos)

HH3. Fastigium strongly rostrate, the lateral ocelli considerably closer to each other than to the median ocellus. Ovipositor longer in proportion to caudal femur, with apex as wide as deep. Sides of pronotum and tegmina decidedly darker than elsewhere. (Occipital pale stripes decided and conspicuous. Female tegmina much as in *festae*. ♀ length of tegmen 4.3 and 4.6, length of caudal femur 14.8 and 16.8, length of ovipositor 13.3 and 15.8 mm.) Peru. *Amusodes andeanum* new species

[19] Unfortunately the following three species are known only from females.

[20] In *Amusodes andeanum* irregular fusion of these veins has occurred in both specimens before us.

EE4. Impressions of pronotal disk distinct. Antennae and limbs not annulate. Size very large. (Fastigium showing distinctly less declivity and more rostrate than is usual in the Group, with median ocellus transverse, situated in a shallow depression and cephalad rather than dorsad. Lateral ocelli distinctly less widely separated from each other than from median ocellus. Female tegmina corneous, venation of feebly convex dorsal fields very obscure, this field delimited from the vertical lateral fields by the decided, raised humeral vein, the lateral fields with three or four unbranched longitudinal veins. Length of tegmen 7.1, length of caudal femur 25.2, length of ovipositor 23.8 mm. Santander, Colombia.
Megalamusus casenare n. gen. and sp.

BB2. Cephalic tibiae lacking auditory foramina.

C3. Eyes not strongly projecting. Palpi not annulate. Limbs short.

D4. Lateral portions of pronotum diverging ventrad so that the ventral angle is distinctly visible from above. Both sexes with short, overlapping, truncate tegmina, having three longitudinal veins in the lateral field. Palpi short, the last two joints white. Ovipositor moderately to decidedly elongate, its apex proximad wider than deep. Limbs not annulate.

E5. Limbs very short. Projection formed by fastigium and face moderately developed [21]. Dorsal surface of body moderately hirsute. Size smaller. Tegmina of female with dorsal fields longitudinally veined.....*Cophella* new genus

F7. Size small. Face very dark brown ventrad. Occiput and disk of pronotum dark brown. Tegmina with median vein and intermediate channel often as dark as elsewhere, never more than slightly paler than other portions.

G4. Disk of pronotum without conspicuous marking. Tegmina blackish laterad, sometimes slightly paler dorsad. Dorsal surface of abdomen and caudal femora dark brown, finely and inconspicuously tessellate with slightly lighter reddish brown. Length of tegmen ♂ 1.8 to 2, ♀ 1.8 to 2.1; length of caudal femur ♂ 5.8 to 6.8, ♀ 6.5 to 7.3; length of ovipositor 7.8 to 8.9 mm. Mountains of Jamaica...*Cophella rehni* new species

GG4. Disk of pronotum with conspicuous flecks of buffy at latero-cephalic angles and along caudal margin. Tegmina

[21] Slightly more so than in *Lerneca*.

uniform brown. Dorsal surface of abdomen and caudal femora brown, intricately and conspicuously tessellate with buffy. ♀ length of tegmen 2.4, length of caudal femur 6.8, length of ovipositor 7.2 mm. Guantanamo, Cuba.

Cophella picta new species

FF7. Size very small. Face dark only laterad, elsewhere, with occiput and disk of pronotum tawny. Tegmina blackish with median vein yellowish buff in sharp and striking contrast. (♂ length of tegmen 1.9 and 2, length of caudal femur 5.7 and 5.8 mm.) Foothills of Jamaica.

Cophella formosa new species

EE5. Limbs short. Projection formed by fastigium and face weak and very broadly rounded. Dorsal surface of body shining, hairs exceedingly minute. Size larger. Tegmina of female with dorsal fields smooth, without contour showing a trace of venation. (Size medium. Last three joints of palpi whitish buff. Head, pronotum and tegmina uniform dark brown, the abdomen dorsad weakly tessellate with a paler shade. Length of tegmen 2.5 and 3.2, length of caudal femur 9.1 and 11, length of ovipositor 6.9 and 7.7.) Porto Rico and Dominica.....*Paracophella carribea* n. gen. and sp.

DD4. Lateral portions of pronotum nearly perpendicular. Female apterous [22]. Palpi elongate, buffy. Ovipositor short, its apex proximad deeper than wide. Limbs moderately annulate. (Projection formed by fastigium and face less decided than in *Cophella*, much as in *Lernecella*. Size small. Head dark brown with genae and median portion of clypeus brownish buff. Dorsal surface of body decidedly hirsute. ♀ length of body 8.3, length of caudal femur 8, length of ovipositor 4.4 mm.) Panama.

Miogryllodes panamae n. gen. and sp.

CC3. Eyes more strongly projecting. Palpi annulate. Limbs of medium length. (Female apterous [22]. Projection formed by fastigium and face weak. Lateral lobes of pronotum diverging so strongly ventrad that the ventral angle is conspicuous from above. Size medium. Ovipositor medium, its apical thickening weak and about as deep as wide. Color light brown, tessellate and limbs annulate with dark brown. Surface polished, but moderately hirsute. ♀ length of caudal femur 8.8, length of ovipositor 8.8 mm. Santander, Colombia.

Anacusta micans n. gen. and sp.

[22] Male unknown.

Inability to place *Amusus mexicanus* Saussure from a generic standpoint has prevented our including this species in the above key. We have, however, commented on it in footnote 10.

In the measurements given in the present paper the exposed length of the tegmina is given. The student must be cautious with females which are apparently apterous. In material before us of *Rehniella glaphyra*, *Tairona pulchella* and *Palpigera borellii*, one female of each has lost both tegmina and it is evident that these appendages are loosely attached and may easily become detached in other species of the Group. We believe that the female sex of *Miogryllodes panamae* shows no tegminal development whatever and that that sex of *Anacusta micans* is also truly apterous.

As is our custom, Ridgway's "Color Standards and Nomenclature" has been used to indicate the exact coloration.

Though largely based on material belonging to the Philadelphia collections, we have been greatly aided by studying material belonging to the United States National Museum, American Museum of Natural History, Carnegie Museum, Museum d'Histoire Naturelle de Genève, Museum National d'Histoire Naturelle (Paris) and British Museum (Natural History).

LERNECELLA new genus

A single new species from the island of Trinidad is included in this genus. The characters which separate the genus from *Lerneca* Walker are given in section C1 of the present key.

Lernecella trinitatis new species (Pl. I, fig. 1.)

The general appearance of this small species more strongly suggests that of *Nemobius carolinus* Scudder than that of any of the other forms of the Group Luzarae.

Type: ♂ ; Caparo, Trinidad, British West Indies. August, 1913. (S. M. Klages.) [Hebard Collection, Type No. 1082.]

In addition to the characters given in the key, the following are noteworthy. Size small and form compact for the Group. Median ocellus round and slightly smaller than the small lateral ocelli, the latter distinctly more widely separated from each other than the distance from one of them to the median ocellus.

Ultimate joint of palpi with dorsal margin weakly concave, this strongest meso-distad; apical oblique truncation occupying two-fifths (nearly half in paratype) length of joint. Tegmina little reduced, with three distinct and two very weak oblique veins. Wings not visible (probably absent). Titillator expanding distad, the lateral portions somewhat produced and terminating in a minute, incurved tooth. Subgenital plate moderately produced, trough-shaped and slightly narrowing, sharply truncate distad. Auditory foramina of cephalic tibiae oval, the tibial surface not impressed beyond. Caudal tibiae with four pairs of spines, the distal pair alone not being almost directly opposed [23], between which are (usually) two minute teeth, while a number of similar teeth precede the proximal spines. Caudal metatarsus with dorso-internal row of teeth represented by a meso-distal and a distal tooth.

General coloration cinnamon brown, pronotal disk faintly maculate with darker, lateral lobes blackish brown. Tegmina with dorsal surface clear brussels brown, obscurely marked with a darker shade.

The measurements of the type are followed by those of a male paratype, taken at Carenage, Trinidad, August, 1909, by M. A. Carriker, Jr. and belonging to the Academy of Natural Sciences of Philadelphia. Length of body 10 [24] and 9, length of pronotum 1.9 and 2.1, length of tegmen 5.5 and 5, width of tegminal dorsal fields 3.9 and 3.9, length of caudal femur 7.2 and 7.7, greatest width of caudal femur 2.7 and 2.7 mm.

MIOGRYLLODES new genus

Erected to include a single Panamanian species, this genus, without males being known, is difficult to place. The large head with eyes little protruding, pronotum with lateral margins nearly perpendicular, absence of auditory foramina on cephalic tibiae, absence of tegmina, short limbs and very short ovipositor are striking features.

[23] Of these distal spines the external is distinctly pre-apical in position, the internal is apical and thus almost directly opposite the dorso-external spur.

[24] With abdomen in natural position this dimension would probably be one millimeter less.

The rather more hirsute covering, general form of palpi and armament of caudal metatarsus agree best with *Lernecella* here described. Males may, however, show *Miogryllodes* to be more closely related to other genera of the Group.

Miogryllodes panamae new species (Pl. II, fig. 1.)

The superficial resemblance of the unique female of this species to small individuals of this sex of *Miogryllus verticalis* (Serville) is decided.

Type: ♀ ; Porto Bello, Panama. August 18 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type No. 1092.]

Size small, form compact. Ocelli small and round, the lateral slightly more widely separated from each other than from the slightly smaller median ocellus. Ultimate joint of palpi with dorsal margin conspicuously and evenly concave; apical oblique truncation occupying almost half of joint and showing marked convexity distad. Tegmina and wings absent. Ovipositor very short and slender, very weakly curved dorsad, its apex little thickened proximad where it is deeper than wide. Subgenital plate small, its lateral margins convex to the concave distal margin.

General body coloration mummy brown maculate with prouts brown. Genae, median portion of clypeus and limbs brownish buff, the latter irregularly annulate with prouts brown, these annuli extensive only on caudal tibiae. Palpi buffy.

The unique female type measures; length of body 8.3, length of pronotum 2, length of caudal femur 8, width of caudal femur 2.8, length of ovipositor 4.4 mm.

To *panamae* or a closely allied species are referred the following specimens.

Pacayas, southeastern slope of Volcan de Irazú, Costa Rica, 6000 to 6200 feet, September 6, 1923, (Rehn and Lankester), 2 juv. ♂, [A. N. S. P.].

Between Cervantes and Pacayas, Costa Rica, 4800 to 5900 feet, October 8, 1923, (Rehn and Lankester), 1 juv. ♀, [A. N. S. P.].

These individuals agree fully except in being darker with limb annuli heavier and in having three instead of two teeth on the dorso-internal margin of the caudal metatarsus. Their appearance is strongly Grylline.

Lerneca fuscipennis (Saussure)

1874. *Diplacusta fuscipennis* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 433. [♂, Brazil.]

1878. *Diplacusta fuscipennis* Saussure, Mém. Soc. Phys. Nat. Genève, XXV, p. 405, pl. 15, section XXXV, figs. 1[25], 2a and 2i. (Figures of type.)

This species was selected as genotype of *Diplacusta* by Kirby in 1906, at which time that genus was placed, we believe correctly, as a synonym of *Lerneca*.

We have not seen material of this insect, *L. funebris* here described being apparently nearest to it of the known species, except that the tegmina have more numerous oblique veins.

Lerneca funebris new species (Pl. I, figs. 2 and 3.)

Compared with the original description of *L. fuscipennis* (Saussure), this insect is found to differ in its smaller size, with tegmina having five or six (instead of three or four) oblique veins and in the darker coloration, with lateral lobes of pronotum solidly blackish brown without a pale ventral margin and limbs almost as dark and not annulate.

The other species which have six oblique tegminal veins have the last two joints of the palpi white.

Type: ♂; Provincia Sara, Bolivia. Elevation 450 meters. (J. Steinbach.) [Hebard Collection, Type No. 1090.]

Size medium small, form moderately elongate. Ocelli forming an equilateral triangle, the median the size of the others, very slightly transverse and with a narrow but conspicuous depression below it. Palpi much as here described for *Lernecella trinitatis* but slightly heavier than in that species. Lateral lobes of pronotum with ventral margin from ventro-cephalic angle ascending very faintly caudad to the much more broadly rounded ventro-caudal angle, where an inner, delicate marginal portion projects narrowly ventro-caudad, this supplementary rim more prominent than in *L. varipes* (Walker) and apparently showing a very similar development to that described by Saussure for his *L. inalata*. Tegmina very slightly (or not in paratype) reduced with dorsal fields weakly racquet-shaped, radiating veinlets of apical area seven in number[26]. Wings not

[25] This figure shows the distinctive venation of the lateral field of the male tegmen.

[26] The upper tegmen with exposed dorsal field is the dextral in the male paratype, but the sinistral (an unusual condition) in the type, with veins consequently reversed in position.

visible (fully developed and caudate in paratype and allotype). Subgenital plate with a medio-longitudinal and meso-lateral depressions which are not deep, narrowing gradually, its lateral margins rounding distad with distal margin faintly concave in ventral aspect and distinctly so in caudal aspect. Auditory foramina of cephalic tibiae elongate oval on caudal faces, similar but decidedly larger on cephalic faces and there followed by a depressed area. Spines and teeth of caudal tibiae as described here for *Lernecella trinitatis*.

Allotype: ♀; Contamano, Rio Ucayali, Peru. October to December, 1912. [A. N. S. P.]

Similar to male, differing as follows. Tegmina not reduced, the dorsal fields with raised longitudinal veins, connected by numerous transverse veinlets which are better defined by color than by contour, lateral fields with mediastine vein sending only four branches to the costal margin. Ovipositor slender, of medium length, its spearhead apex distinctly broader than deep at base. Subgenital plate small, simple, embracing base of ovipositor, in caudal aspect alone appearing deeply U-emarginate.

In addition to the color features given in the key, the following are observed. Antennae light brown with a few broad buffy annuli. The (male) paratype and (female) allotype, but not the (male) type, show four tawny flecks at the caudal margin of the occiput. The dorsal field of the tegmina is immaculate in the type, faintly marbled with lighter brown in the paratype and distinctly so in the allotype.

The measurements of a paratypic male, taken at the mouth of the Rio Teffe on the Rio Solimoens, Brazil, September 5, 1920, by J. C. Bradley, belonging to the author's collection, follow those of the type. Length of body ♂ 11.1 and 11.2, ♀ 9; length of pronotum ♂ 1.8 and 1.8, ♀ 1.8; length of tegmen ♂ 7.8 and 8.8, ♀ 9.5; greatest width of dorsal fields of male tegmen 4.3 and 4.3; exposed length of wings ♂ 0 and 5.7, ♀ 4.3; length of caudal femur ♂ 6.8 and 7.2, ♀ 7; greatest width of caudal femur ♂ 1.8 and 1.8, ♀ 1.9; length of ovipositor 6.1 mm.

Lerneca varipes Walker. (Pl. I, figs. 4 and 5.)

1869. *Lerneca varipes* Walker, Cat. Dermapt. Saltat. Birtish Mus., I p. 72. [♂, Amazon Region.]

Saussure, in 1874, included this species without comment, the genotype of *Lerneca* by monotypy, when erecting the generic synonym *Diplacusta*.

France Field, Canal Zone, Panama, July 7, 1920, (M. Hebard; in leaf litter on bare ground under palms in swamp area), 1 ♂, 1 ♀, (♂ brachypterous, ♀ macropterous), 1 juv., [Hebard Cln.].

Gatun, Canal Zone, Panama, July 17 to 23, 1916, (D. E. Harrower), 1 ♂, (brach.), 1 small juv., [Hebard Cln.].

Gold Hill, Canal Zone, Panama, November 17, 1913, (M. Hebard; in leaf litter under brush heavily overgrown with vines), 1 juv. ♀, [Hebard Cln.].

Corozal, Canal Zone, Panama, November 17, 1913, (M. Hebard; in blackish decaying vegetable matter on ground under vines), 1 ♀, (brach.), [Hebard Cln.].

Gulf of San Blas, Colon, Panama, July, 1922, (D. E. Harrower), 1 ♂, (brach.), [Hebard Cln.].

Aracataca, Magdalena, Colombia, August 13, 1920, (M. Hebard; small colony in dry leaves on damp soil of dense and lofty forest), 1 ♂, 1 ♀, (brach.), 2 juv. ♂, [Hebard Cln.].

Caparo, Trinidad, June, 1913, (S. M. Klages), 4 ♀, (3 brach., 1 macr.), [A. N. S. P.]; August, 1913, (S. M. Klages), 9 ♂, 15 ♀, (all brach.), 2 juv. ♂, [Hebard Cln.].

Paramaribo, Dutch Guiana, (K. Mayo), 1 ♂, (brach.), [A. N. S. P.].

Igarapé-Assú, Pará, Brazil, (H. S. Parish), 1 ♀[27], (macr.), [A. N. S. P.].

Villa Montes, Bolivia, November, 1917, (Lizer and Deletang), 1 ♂, (brach.), [A. N. S. P.].

It is rather surprising to find that material additional to the type was not recorded for nearly fifty years. It is evident that the insect is widely distributed through the lowlands of tropical South America, reaching as far north as Panama, but not into Costa Rica. Over this area it is probably confined to the forested areas, where it lives on the ground among dead leaves and litter. Like most of the species of the present group *varipes* is extremely quick in its movements, its cryptic coloration increasing the collector's difficulties when attempting to secure a series in the darkened areas where it normally occurs.

The following field note was made at Aracataca "I know of no other cricket so quick in movement. When resting motionless on the dead leaves an individual could sometimes escape after the hand was cautiously brought to not more than an inch over it and then slapped sharply down."

[27] First recorded by Rehn; Proc. Acad. Nat. Sci. Phila., 1918, p. 214.

Compared with those of *L. funebris* here described, the male tegmina of *varipes* show a generally similar but even higher specialization. The humeral vein is a little more distant from the median vein, but in *varipes* the latter is conspicuously elevated while in *funebris* it is not. We believe that *L. fuscipennis* (Saussure) and *funebris* agree in this feature. In the dorsal field four to six oblique veins are shown by the present series, indicating that their number is subject to considerable individual variation and should not be emphasized in distinguishing the species of the genus, as was done by Saussure. The male subgenital plate is scoop-shaped, each half rounding broadly distad, medio-longitudinally forming a very narrow V-shaped cleft, before which the surface of the plate is feebly sulcate but with a suture running to its base.

The previously undescribed female closely resembles the male except in having much more simple tegmina, with dorsal fields weakly convex and traversed by a number of longitudinal veins, often more or less irregular, the ulnar usually forked, these veins connected by irregular veinlets. The lateral fields are nearly vertical, the mediastine vein longitudinal, with three branches proximad, these curving and two of them paralleling the mediastine vein for some distance, these veins also connected by transverse veinlets. The delicate ovipositor curves dorsad, its apex very slightly thickened at the base, but there appreciably broader than deep.

In addition to the shining black face, blackish pronotal lateral lobes and milk white terminal two palpal joints, the species is further distinguished by a somewhat more grayish than brownish general dorsal coloration than the other species of the Group. The tibiae are distinctly but not regularly annulate, the cephalic and median femora weakly so, the caudal femora mottled with slightly darkened apices and external surface showing oblique, broken inconspicuous darker lines.

As this is the only species of the Group Luzarae of which we have sufficient material for variational studies the following measurements (in millimeters) are given.

♂	Length of body	Length of pronotum	Length of tegmen	Meso-distal width of dorsal tegminal fields	Length of caudal femur	Length of ovipositor
France Field, Panama	9	1.8	8.7	4.8	8	——
Gatun, Panama	9.2	1.8	9.1	5	8.9	——
Caparo, Trinidad	11.1	2.1	8.8	5.3	9	——
Caparo, Trinidad	12	2.2	9.8	5.6	9.8	——
Villa Montes, Bolivia.	8.9	1.8	7.8	4.7	7.1	——
♀						
France Field, Panama	11.2	2	10.8 [28]	——	9	7.2
Corozal, Panama	9.3	1.9	6.4	——	7.8	6.7
Caparo, Trinidad	10.7	2.1	7.2	——	9.1	7.7
Caparo, Trinidad	12.2	2.1	8.2	——	9.4	8
Paramaribo, Dutch Guiana	10.1	2	8.1	——	8.8	7.4
Pará, Brazil	11.3	2.1	10.8 [29]	——	8.9	7.9

Lerneca inalata (Saussure)

1874. *Diplacusta inalata* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 435. [♂, Surinam.]

This insect is, we believe, nearest *L. varipes* Walker, probably closer than would be inferred from Saussure's original description.

It is apparently separable from *varipes* by a number of features which also serve to distinguish *L. funebris* here described from its close relative *L. fuscipennis* (Saussure).

Prosthacusta circumcincta (Scudder)

1868. *Nemobius circumcinctus* Scudder, Proc. Boston Soc. Nat. Hist., XII, p. 143. [♂, Orizaba, [Vera Cruz,] Mexico.]

1874. *Prosthacusta mexicana* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 437, pl. 7, figs. 18 and 18*. [♂, Cordova, (= Cordoba, Vera Cruz) Mexico.]

Scudder established the above synonymy in 1896 [30]. We have recently seen the specimen described by Saussure, in the

[28] In this, a macropterous specimen, the wings, usually concealed, project a distance of 4.8 mm. beyond the tegmina.

[29] Macropterous; exposed length of wing 4.4 mm.

[30] Jour. New York Ent. Soc., IV, p. 99.

Geneva Museum. There is also in that collection a specimen of the previously unknown female, taken at Teapa, Tabasco, Mexico, by H. H. Smith. The slightly overlapping tegmina are, in that sex, less than half the length of the abdomen, with veins of lateral fields curving to become longitudinal (five in the male, three and four in the female). The dorso-internal spur of the caudal tibiae is nearly as long as the metatarsus.

COPHELLA new genus

Two species from Jamaica and one from eastern Cuba are here described. All strongly suggest species of *Nemobius* Serville, a genus of the Nemobiinae.

Genotype.—Cophella rehni new species.

Cophella rehni[31] new species (Pl. I, fig. 6; pl. II, fig. 3.)

This is a species of small size (though largest of the genus), compact build and obscure coloration, known only from the summit of the Blue Mountains divide at a considerable elevation.

Type: ♂; Morces Gap, Blue Mountains, Jamaica. Elevation 4980 feet. July 30, 1923. (J. A. G. Rehn.) [A. N. S. P., Type No. 5433.]

Only characters additional to those in the key are given. Size small, form very compact, limbs short for the group. Ocelli very small and inconspicuous, the lateral distinctly more widely separated from each other than from the median. Ultimate joint of palpi with dorsal margin straight, oblique truncation occupying half (or very slightly less than half) length of joint. Tegmina decidedly reduced; stridulating vein obsolete, humeral vein heavy, mediastine and one free vein slightly less heavy, median vein weaker but conspicuous, ulnar vein weak, few veins toward sutural margin even weaker, a few irregular veinlets indicated distad. Wings absent. Titillator forming a tube not enlarged distad, apices on each side dorsad with a delicate aciculate projection. Subgenital plate scoop-shaped, tapering to the truncate apex which, due to the elevation of the sides, often appears U-emarginate in caudal aspect. Caudal tibiae as here described for *Lernecella trinitatis*.

[31] Named in honor of Mr. James A. G. Rehn who, during his stay in Jamaica, secured many new and interesting species of Orthoptera.

Allotype: ♀ ; same data as type. [A. N. S .P.]

Size larger than male. Tegmina similarly reduced, with more numerous weakly defined longitudinal veins in dorsal field. Ovipositor elongate and very slender, curving moderately dorsad but straightening out at apex, the latter shaped like a spear-head, widest at its rounded base and there distinctly wider than deep. Subgenital plate small, lateral margins convex to the concave distal margin.

The dorsal surface of the abdomen is reddish brown, very heavily but not conspicuously tessellate and suffused with dark brown, this much better defined in recessively colored individuals.

The measurements of the type and allotype are followed by those of the extremes among six male and six female paratypes, bearing the same date but taken July 19 to 30. Length of body ♂ 9.1, 8.3 to 10; ♀ 11, 8.3 to 10.8: length of pronotum ♂ 1.9, 1.7 to 2; ♀ 2.1, 2 to 2.2: length of tegmen ♂ 1.8, 1.8 to 2; ♀ 2, 1.8 to 2.1: width of dorsal fields of tegmina ♂ 2.5, 2.3 to 2.7: length of caudal femur ♂ 6.7, 5.8 to 6.8; ♀ 7, 6.5 to 7.3: width of caudal femur ♂ 2, 1.8 to 2; ♀ 2.2, 2 to 2.3: length of ovipositor 8.9, 7.8 to 8.8 mm.

The series was taken in the leaf-litter of the forest floor. They were numerous but only found in a small, heavily shaded area beside the trail.

Cophella picta new species (Pl. II, fig. 4.)

This insect is apparently very closely related to *C. rehni* here described, the most striking difference being the conspicuous buffy tessellation of the pronotum and dorsal surfaces of the abdomen and caudal femora. The venation of the uniformly colored tegmina is also apparently more regular. In addition *picta* appears to have a proportionately deeper pronotum, slightly less reduced tegmina and shorter caudal femora and ovipositor, but without a larger series of the present insect and knowing that considerable individual variation occurs in *rehni*, these features should not be given much weight until additional material can be studied.

Type: ♀ ; Rio Seco, San Carlos Estate, Guantanamo, Cuba. April 24, 1914. (C. T. Ramsden.) [A. N. S. P., Type No. 5436.]

Size about that of the medium shown by the series of *rehni*, form and limbs similar. Ocelli moderately large, larger than

in that species but similarly placed. Palpi, tegmina, ovipositor and caudal tibiae as in *rehni*. Tegmina similarly decidedly reduced, but with the three veins in the lateral field not as heavy and those of the dorsal field more evenly longitudinal without irregularities or veinlets distad.

The tessellation is striking, as noted in the key and above.

A paratypic female, one large immature male and one small immature male, bearing the same data are before us, as well as a female and three small immature individuals, taken on San Carlos Estate, October 4 to 8, 1913, by F. E. Lutz, under rotten logs in high forest, which belong to the American Museum of Natural History. The measurements of the larger adult paratype follow those of the type. Length of body 9.3 to 9.8, length of pronotum 2.2 to 2.3, length of tegmen 2.4 and missing, length of caudal femur 6.8 and 6.8, width of caudal femur 2.2 and 2.2, length of ovipositor 7.2 and 7 mm.

It is of interest to note that apparently *picta* is a lowland Cuban species and *rehni* a highland Jamaican species.

Cophella formosa new species (Pl. II, fig. 2)

This insect is not only the smallest but also the most brilliantly colored species of the Group Luzarae.

Type: ♂ ; Stoney Hill, Jamaica. Elevation 1200 feet. October 25, 1913. (M. Hebard.) [Hebard Collection, Type No. 1091.]

The important characters given in the key are not repeated here. Size very small, form very compact, limbs short for the group. Ocelli very small, circular, the lateral distinctly more widely separated from each other than from the median. Ultimate joint of palpi with dorsal margin straight, the apical oblique truncation occupying distinctly over half the length of the joint. Tegmina decidedly reduced, with dorsal fields showing very faintly longitudinal veins, stridulating vein obsolete; median vein very conspicuously indicated in color but not at all in contour, humeral vein separating dorsal and lateral fields, mediastine and one free vein strongly indicated in contour. Wings absent. Titillators forming a tube not enlarged distad, apices on each side ventrad, with a very fine, delicate tooth, dorsad with rounded (in lateral aspect) apices more chitinous, from which projects a similar delicate tooth. Subgenital plate convex; apex straight, truncate dorso-distad; surface toward apex very slightly and broadly impressed. Caudal tibiae as here described for *Lernecella trinitatis*.

Coloration rich and distinctive, as given in key. Antennae tawny shading beyond base to buckthorn brown, without annuli. Dorsal surface of abdomen showing traces of reddish brown tessellation, this conspicuous in the immature specimens.

A paratypic male, bearing the same data as the type, is measured last. Length of body 7.2 and 7.2, length of pronotum 1.6 and 1.7, length of tegmen 1.9 and 2, width of tegminal dorsal fields 2.1 and 2.2, length of caudal femur 5.8 and 5.7, greatest width of caudal femur 1.7 and 1.7 mm.

Three immature individuals were taken at the same time; one a large male, one a medium sized male and one a small female. This series was found in the dead leaf litter under the low but heavy hillside forest, in company with the cockroaches *Cariblatta reticulosa* (Walker), *C. cuprea* Hebard and *C. cryptobia* Rehn and Hebard, at an elevation of 1200 feet.

PARACOPHELLA new genus

The characters which separate this genus from *Cophella*, here described, are given in the accompanying key. A single species from Porto Rico and Dominica is included.

Paracophella caribbea new species (Pl. III, fig. 1.)

Though agreeing in many respects with the species of *Cophella* here described, the larger size and smooth dorsal surfaces of the tegmina give to *P. caribbea* a very different appearance, resembling more closely such species as *Rehniella glaphyra* and *Niquirana polita* also described in the present study.

The coloration is obscure, affinity to *Cophella* being shown by the pale palpal joints and weak tessellation of the dorsal surface of the abdomen.

Type: ♀ ; Laudet, Dominica, British West Indies. June 12, 1911. (F. E. Lutz.) [Amer. Mus. Nat. Hist.]

We add the following data to that given in the key. Size medium; limbs moderately elongate, longer than in *Cophella*, this more noticeable in the cephalic and median pairs[32]. Ocelli

[32] The limbs of a female from Porto Rico are much shorter than those of the type. Males may show that a distinct species is represented, but so close is the agreement in all other features between these two females, that we do not feel we would be justified in separating them specifically at present.

circular, the lateral larger than and distinctly more widely separated from each other than from the median. Palpi distinctly more elongate than in *Cophella*, ultimate joint with dorsal margin feebly concave, apical oblique truncation weakly convex and occupying slightly over two-fifths length of joint. Tegmina decidedly reduced, with mediastine and two free veins very slightly less decided than the humeral vein, these veins all very regular. Wings absent. Ovipositor comparatively short, curved very weakly dorsad with apical portion conspicuously horizontal; apex as here described for *Cophella rehni*. Subgenital plate as in that species.

The general coloration is shining blackish chestnut brown, becoming deeper caudad on the pronotum in the type, a female from Porto Rico having the tegmina solidly darker. The femora are slightly paler, with apices of caudal femora slightly suffused. The faint dorsal abdominal tessellations are suffused buckthorn brown with a tawny tinge.

The measurements of the type are followed by those of a female, taken at Aibonito, Porto Rico, August 14, 1919, by K. P. Schmidt, in the Hebard Collection. Length of body 12.2 and 11.3, length of pronotum, 3.8 and 3.4, length of tegmen 3.2 and 2.5, length of caudal femur 11.2 and 9.1, width of caudal femur 3.6 and 3.4, length of ovipositor 7.7 and 6.9 mm.

The type was found in leaves in a very humid forest.

GRYLLOSOMA new genus

The genus is characterized in the accompanying key. The two species referred to it, from Panama and the Colombian Chocó, are very closely related and possibly represent geographic races.

Genotype.—*Gryllosoma esau* here described.

Gryllosoma esau new species (Pl. III, fig. 2; pl. IV, fig. 1.)

This is a species of the lowland forests of Panama. The coloration, though somber, is striking. The general facies is Grylline.

Type: ♂; Porto Bello, Panama. August 18 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type No. 1094.]

Characters given in the key are not repeated here. Size slightly below medium, form robust for the Group. Ocelli small and round, the lateral slightly more separated from each other than from the slightly smaller median ocellus. Ultimate joint

of palpi rather heavy, expanding very slightly distad, its dorsal margin very faintly concave, the apical truncation occupying slightly over one-third length of joint. Tegmina decidedly reduced, with dorsal fields flattened and caudal margin coarsely and conspicuously notched at each disto-lateral angle. Wings absent. Titillators forming a heavily chitinous tube, broader than deep and not enlarged at apex, the lateral portions projecting there with margins rounded truncate, these with external surfaces convex and internal surfaces concave. Subgenital plate trough-shaped, narrowing slightly distad and sub-bilobate at apex. Auditory foramina of cephalic tibiae oval, the tibial surface slightly flattened for a brief distance beyond. Caudal tibiae and metatarsi as here described for *Lernecella trinitatis*, the teeth between the spines and those along the dorsal margins of the caudal metatarsi comparatively heavy.

Allotype: ♀ ; same data as type. [Hebard Collection.]

Larger than male. Tegmina slightly more reduced, with dorsal surfaces showing faint traces of irregular veins and disto-lateral notches of caudal margin absent. Ovipositor short and very slender, evenly curved dorsad, base of acute apical portion scarcely thicker than shaft and there slightly deeper than wide. Subgenital plate small, its lateral margins curving to the scarcely concave distal margin.

To the color features given in the key the following are added. Cephalic and median femora bright chestnut. Caudal femora dresden brown finely lined with mummy brown, these lines externally oblique, apices suffused with mummy brown.

Three paratypes, a male and two females taken at Gatun, August 6 to 22, 1916, by D. E. Harrower, agree closely with the type and allotype in size. Length of body ♂ 13, ♀ 13.5; length of pronotum ♂ 2.8, ♀ 3; length of tegmen ♂ 3.2, ♀ 2.7; width of tegminal dorsal fields ♂ 4; length of caudal femur ♂ 9, ♀ 10.7; width of caudal femur ♂ 3.2, ♀ 3.7; length of ovipositor 7.2 mm.

There are also before us five immature males and nine immatrue females bearing the same data as the type. These represent at least three instars.

Gryllosoma choco new species (Pl. III, fig. 3.)

This species agrees very closely with *G. esau* here described, differing mainly in the features noted in the key.

Type: ♀ ; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1095.]

Form moderately robust for the group, slightly less so than in this sex of *esau*. Tegmina decidedly but not as greatly reduced as in that species, dorsal fields slightly longer than broad instead of being of approximately equal length and width. Ovipositor and subgenital plate as in *esau*. The important generic and specific characters given in the key are not repeated here.

General coloration slightly paler and less reddish than in *esau*. Head and pronotum very dark chestnut brown. Tegmina with dorsal fields no more tawny than dorsal surface of abdomen, lateral fields chestnut brown.

The female type measures; length of body 12.8, length of pronotum 2.7, length of tegmen 2.9, length of caudal femur 9.8, width of caudal femur 3.3, length of ovipositor 7 mm.

Two immature specimens from the same locality are similarly less robust than the corresponding instars of *esau*.

TAIRONA new genus

A single species from Sierra San Lorenzo, in the Santa Marta Region of Colombia, is here included. Its superficial appearance is somewhat Grylloid, but not as much so as in *Gryllosoma* here described, anything more than a cursory glance suggesting that it belongs rightly to the Group Luzarae.

Tairona pulchella new species (Pl. IV, figs. 3 and 4; pl. V, fig. 4; pl. VI, fig. 3.)

Though exhibiting few features of decided individuality, this insect shows a combination of characters which separates it widely from any of its allies.

The contrast in size between the sexes is decidedly greater than is usual in most species of the Group.

Type: ♂; Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. Elevation 5000 feet. July 10, 1913. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1089.]

The following characters supplement those given in the key. Size below medium, from moderately robust, limbs of moderate length for the Group. Ocelli small and almost round, the lateral scarcely more widely separated from each other than from the slightly smaller median ocellus. Palpi of medium length, penultimate joint slender, ultimate showing a feeble concavity of the dorsal margin particularly meso-distad, the

apical truncation convex and occupying two-fifths the length of the joint. Tegmina decidedly reduced with dorsal fields evenly and weakly convex and caudal margin evenly rounded at the disto-lateral angles; humeral vein, separating the dorsal and lateral fields, weaker than the regular mediastine and single free vein of the latter field. Wings absent. Supra-anal plate simply shield-shaped and slightly wider than long, but surface mesad unusually specialized, armed there with a pair of heavy teeth directed dorso-caudad (Pl. VI, fig. 3). Titillators broad, chitinous distad, with two rounded lamellate fingers projecting on each side and directed meso-caudad, each with a small proximo-internal tooth. Subgenital plate trough-shaped, scarcely narrowed to the broadly truncate apex, its surface with a broad and shallow medio-longitudinal sulcus. Auditory foramina of cephalic tibiae oval and slightly impressed, the cephalic moderately large, the caudal smaller. Caudal tibiae and metatarsi armed much as in *Gryllosoma esau* here described and similarly hairy.

Allotype: ♀; same data as type. [Hebard Collection.]

Considerably larger than male and more robust. Tegmina more reduced, similarly veined except for absence of sulcation of "archet", more truncate, the dorsal fields each slightly longer than wide. Supra-anal plate simple. Ovipositor of medium length, very slender, evenly curved dorsad, base of acute apical portion moderately and convexly thickened, there distinctly wider than deep (Pl. V, fig. 4). Subgenital plate small, truncate distad, but in caudal aspect there appearing U-emarginate.

General coloration of head, pronotum, abdomen and limbs individually varying from tawny to deep russet, the intensive examples only with sides of head and pronotum appreciably darker. Palpi ochraceous buff with terminal joint light ochraceous buff. Tegmina mummy brown with dorsal fields margined (broadly cephalad and caudad in male, caudad and proximo-laterad and very narrowly laterad in female) with buffy white.

The males average distinctly more recessive in coloration than the females. In the former the abdomen is dark dorsad, but in both light and dark females it shows there delicate and inconspicuous tessellation. Only in the darker specimens are the caudal femora obliquely streaked externally and have their apices suffused with darker brown, the caudal tibiae also being darkened.

Length of body ♂ 8.8, ♀ 12.3; length of pronotum ♂ 2.1, ♀ 2.7; length of tegmen ♂ 3.2, ♀ 2.4; total width of tegminal dorsal fields ♂, 2.9; length of caudal femur ♂ 7.2, ♀ 9.8; width of caudal femur ♂ 1.9, ♀ 2.8; length of ovipositor 7.8 mm.

Specimens Examined: 39; 8 males and 31 females.

Minca, Magdalena, Colombia, 2500 feet, July 24, 1920, (Rehn and Hebard), 2 ♂ 3 ♀, *paratypes,* [A. N. S. P. and Hebard Cln.].

Hacienda Victoria, Sierra San Lorenzo, Magdalena, Colombia, 4100 feet, July 31, 1920, (M. Hebard; under decaying litter of dead leaves and banana stalks), 1 ♂, *paratype,* [Hebard Cln.].

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia, 4000 to 5000 feet, July 10, 1913, (M. A. Carriker, Jr.), 1 ♂, 3 ♀, *type, allotype, paratypes,* [Hebard Cln.]; 4000 feet July 16 to 25, 1920, (Rehn and Hebard; among dead leaves under hillside forest), 3 ♂, 24 ♀, *paratypes,* [A. N. S. P. and Hebard Cln.].

Trail between Hacienda Cincinnati and Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, Colombia, 4500 to 4700 feet, July 21, 1920, (J. A. G. Rehn), 1 ♂, 1 ♀, *paratypes,* [A. N. S. P.]

NIQUIRANA new genus

This genus is erected to include a single Nicaraguan species, evidently nearer *Tairona pulchella* here described than to the other forms of the Group Luzarae. In the male sex striking differences from that insect are the hairless and shining head, pronotum and tegmina, the latter without an impressed "archet" and with more numerous veins in the lateral fields, simple supra-anal plate and other features of generic value given in the key.

Saussure's *Amusus mexicanus* may belong to this or a related genus [33].

Niquirana polita new species (Pl. VI, fig. 4.)

This handsome species, like *Tairona pulchella* here described, has the caudal margin of the dorsal fields of the male tegmina buffy, but differs in all other conspicuous features of coloration.

It is evidently an annectant type between the preceding species and those of *Luzara* Walker and their allies.

Type: ♂; Nicaragua. [Hebard Collection, Type No. 1096.]

[33] We discuss that species on page 6, footnote 10.

Important characters given in the key are not repeated here. Size slightly below medium, much as in *Gryllosoma esau* here described, form and limbs more slender. Ocelli rather small, round, the lateral slightly more widely separated from each other than from the median ocellus. Palpi of medium length, ultimate joint with dorsal margin weakly concave, oblique distal truncation broadly convex, occupying over two-fifths length of joint. Tegmina reduced but not as much so as in *Tairona*, differing as noted above. Wings absent. Supra-anal plate resembling that of *Gryllosoma esau* but with disto-lateral marginal concavity less decided and apex convex. Titillators distad with no decided productions, but with four stout, uncinate, incurved projections visible. Subgenital plate evenly trough-shaped, surface convex with no sulcation, distal margin rather broadly truncate. Auditory foramina of cephalic tibiae moderately large, elliptical. Caudal tibiae and metatarsi armed as in *Gryllosoma*, but the four pairs of spines even shorter and more strongly alternating.

Head, antennae, proximal palpal joints, pronotum and cephalic and median limbs shining blackish brown; abdomen and cerci slightly paler, the former weakly tessellate and less glabrous. Apical two joints of palpi whitish. Tegmina and caudal femora clear hazel, the former with caudal margin of dorsal fields buff, the latter becoming chestnut brown distad as are the caudal tibiae and tarsi.

Length of body 12, length of pronotum 2.9, length of tegmen 4.6, total width of tegminal dorsal fields 4, length of caudal femur 9.7, width of caudal femur 2.8 mm.

A large immature female, bearing the same data, agrees closely except in the much paler coloration with cephalic and median tibiae annulate and sides of the pronotum dark with a striking oblique band of buff. This specimen is clearly congeneric, but whether or not specifically distinct can only be determined through additional material.

AMUSINA new genus

This genus is proposed for the reception of a single Ecuadorean species, originally described as *Amusus kraussi* by Griffini. The original generic assignment was made through recognition of the fact that nearest relationship was to *Amusus mexicanus* Saussure, a species actually widely generically distinct from *Luzara* (of which *Amusus* is a synonym). We have given the characters distinguishing *Amusina* in the present

key, showing that it is well separated from *Luzara* and commenting there on the evident closer affinity of Saussure's *mexicanus* to *kraussi* in footnote 10.

Amusina kraussi Griffini

1898. *Amusus kraussi* Griffini, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XIII, No. 319, p. 1. [♂, ♀, juv.; Rio Peripa and Valley of Santiago, Ecuador.]

We have received in exchange from the University of Turin a paratypic pair, enabling us to describe the new genus which this distinctive species represents. It is clearly nearest the genera *Niquirana, Rehniella* and *Prosthama* here described, in general appearance, however, more strongly suggesting *Amusodes festae* (Giglio-Tos) but readily distinguishable by numerous characters given in the key. The distinctive venation and minute impressed punctae of the male tegmina, minute lateral female tegmina, rather short limbs and proportionately short ovipositor are among the more striking of these. The original description of the species is excellent.

——— **mexicanus** (Saussure)

1897. *Amusus mexicanus* Saussure, Biol. Cent.-Amer., Orth., I, p. 245, pl. XII, figs. 11 to 13, [♀; Teapa, Tabasco, Mexico.]

Though from the description and figures we are unable to place this species generically, it is apparently nearest *Niquirana* and *Amusina* here described. It is clear that *mexicanus* is a species strikingly distinct from any other of the Group Luzarae.

REHNIELLA[34] new genus

This genus is erected to include a single species from the highlands of Costa Rica.

It is nearest *Prosthama* here described, but is readily separable by the characters given in the present key.

Rehniella glaphyra new species (Pl. V, figs. 1 and 2; pl. VI, fig. 1.)

Though very dark in general coloration without conspicuous markings, the smooth and highly polished surface of this species gives it a striking appearance.

[34] Named in honor of a friend, Mr. James A. G. Rehn, who secured the series here described of this interesting new genus and species.

Type: ♂ ; La Palma, between Irazú and Barba Volcanoes, Costa Rica. Elevation 4960 to 5100 feet. September 1, 1923. (Rehn and Tristan.) [A. N. S. P.]

We have not repeated here important characters given in the key. Size and form medium for the Group. Ocelli elliptical, the lateral moderately large, distinctly more widely separated from each other than from the smaller median ocellus, about which the fastigio-facial projection is flattened but shows no impression. Ultimate joint of palpi with dorsal margin moderately concave, this strongest meso-distad, apical oblique truncation occupying about two-fifths length of joint. Tegmina decidedly reduced, concealed portion of sinistral tegmen membranous and hyaline, the margin of this area with two curved veins which follow the curved sutural margin of the dextral tegmen. Wings absent. Supra-anal plate with emarginations opposite cercal bases, thence shield-shaped [35]. Titillators complex, expanding and strongly chitinous distad with a stout, erect, recurved finger on each side. Subgenital plate simple, briefly scoop-shaped with apex rather broadly truncate, the surface without impression or sulcus. Auditory foramina of cephalic tibiae moderately large, elliptical, the tibial surface not showing impression. Caudal tibiae and metatarsi as here described for *Lernecella trinitatis*, the teeth between the spines and those on the dorsal margins of the metatarsi numerous and comparatively large.

Allotype: ♀ ; between Cervantes and Pacayas, Costa Rica. Elevation 4800 to 5900 feet. September 8, 1923. (Rehn and Lankester.) [A. N. S. P.]

Larger than male. Tegmina slightly more reduced, symmetrical, attingent (or slightly overlapping mesad); dorsal fields smooth, without veins, curving evenly into the lateral fields which are delimited dorsad by the straight humeral vein and include the unbranched mediastine and one free vein. Ovipositor of medium length, very feebly curved dorsad to the slightly thickened base of the acute apical portion and there distinctly deeper than wide. Subgenital plate small, truncate distad (individually varying to bilobate in females from the same locality).

The present series shows marked individual variation in degree of tegminal reduction.

[35] This is generally of the usual form for the species of the group and is figured, plate VI, figure 1.

All of body shining and almost black, abdomen slightly paler. Head with supra-ocular buffy lines and minute suffusions of the same laterad and sometimes mesad on the cephalic margin of the pronotum in recessive examples, flecks of the same laterad on the abdominal tergites very weakly indicated but becoming numerous in individuals of decided recession. Antennae blackish, with widely spaced, very narrow but sharply defined annuli of buff. Palpi whitish, but with each joint evenly suffused ventrad with mummy brown. Femora clear ochraceous tawny or tawny, darkened distad. Tibiae and tarsi blackish brown, the cephalic and median with irregular but conspicuous annuli of ochraceous tawny, the caudal with a single pale annulus proximad.

The intensively colored specimens almost lack the pale markings on head, pronotum and dorsal surface of abdomen, which are strongest in the most recessively colored individuals. Recession is more marked in the females and an immature example of that sex shows the greatest recession found in the present series.

Measurements (in millimeters) of extremes

♂	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur	Width of dorsal fields of tegmina
La Palma, *Type*	12.1	2.8	2.6	9.7	3.7
La Carpintera. *Paratype*	13.8	2.9	2.8	——	4
Pacayas. *Paratype*	13.1	3.1	3.2	10.7	4.1
Cervantes to Pacayas. *Paratype*	13.8	3.2	3.2	10.8	4.2
♀					Length of ovipositor
Cervantes to Pacayas. *Allotype*	14	3.7	3	12	11.8
Cervantes to Pacayas. *Paratype*	14	3.8	3.3	12.8	——
La Carpintera. *Paratype*.	13.8	3.4	——	10.9	10.3
La Carpintera. *Paratype*.	13.7	3.1	1.8	10.3	9.7

Specimens Examined: 9; 4 males, 4 females and 1 immature individual.

La Palma, between Irazú and Barba Volcanoes, Costa Rica, 4960 to 5100 feet, September 1, 1923, (Rehn and Tristan; in vines and low vegetation in recent clearing), 1 ♂, *type,* 1 large juv. ♀, [A. N. S. P.].

Between Cervantes and Pacayas, Costa Rica, 4800 to 5900 feet, September 8, 1923, (Rehn and Lankester; jumping about on ground cover in forest), 1 ♂, 2 ♀, *allotype* and *paratypes,* [A. N. S. P.].

La Carpintera, Candelaria Mts., Costa Rica, 5100 to 6100 feet, September 4, 1923, (Rehn and Lankester; found under logs and stones in forest), 1 ♂, 2 ♀, *paratypes,* [A. N. S. P.].

Pacayas, southeastern slope of Irazú Volcano, Costa Rica, 6000 to 6250 feet, September 6, 1923, (Rehn and Lankester; under bark of dead tree where *Miogryllodes* immatures and a new species of the Group Heterogrylli were also found), 1 ♂, *paratype,* [A. N. S. P.].

PROSTHAMA new genus

The single species here described occurs in the lowlands of Costa Rica and Panama. It is nearest *Rehniella glaphyra* here described, that insect being larger and more glabrous and apparently taking its place in the highlands of Costa Rica.

The generic characters are given in the key.

Prosthama tessellata new species (Pl. IV, fig. 2; pl. V, fig. 3; pl. VI, fig. 2.)

The general appearance of this insect would suggest the genus *Nemobius* Serville, were it not for its more slender form, elongate limbs and very different male tegmina.

Type: ♂; La Emilia, near Guapiles, Costa Rica. Elevation 1000 feet. August 20, 1923. (J. A. G. Rehn.) [A. N. S. P., Type No. 5435.]

Important characters given in the key are not repeated. Size small, form moderately slender. Ocelli circular, small, the lateral slightly larger and forming with the median an almost equilateral triangle, the median with a very small impression along its ventral margin. Ultimate joint of palpi very elongate, its dorsal margin showing appreciable concavity distad, oblique truncation of apex occupying only slightly over one-fifth length of joint. Tegmina reduced, concealed portion of sinistral tegmen partially membranous and veined. Wings absent. Supra-anal plate distinctive (Pl. VI, fig. 2). Titillators not visible. Subgenital plate shallowly scoop-shaped with broadly truncate apex, surface with a very broad but distinct medio-longitudinal sulcus in distal portion. Auditory foramina of cephalic tibiae small, elliptical, the tibial surface there somewhat flattened.

Caudal tibiae with four pairs of spines which are short for the Group and weakly alternating, the minute teeth before them numerous and moderately stout. Caudal metatarsus with dorsal margins armed with fewer teeth than in *Rehniella glaphyra*, the internal of these margins particularly with fewer (three to five in the series) such teeth.

Allotype: ♀; same data as type, but taken August 20, 1923. [A. N. S. P.]

Slightly larger than male. Tegmina very greatly reduced, represented by very small, rounded-triangular lateral pads, which however show the simple and regular humeral, mediastine and one free veins as in the male. Ovipositor of medium length, moderately curved dorsad to the suddenly thickened base of the acute apical portion, there distinctly wider than deep (Pl. V, fig. 3). Subgenital plate small, with distal margin faintly concave.

The maxillary palpi are light brownish buff, with very faint suffusions of brown, particularly ventrad. The fine tessellation of reddish brown on the dorsal surface of the abdomen is sometimes almost obsolete, usually apparent but not conspicuous. The limb annulation is weak and often the darker brown markings form rather maculations than annuli.

The measurements of the allotypic female are followed by those of a paratype from Vesta Farm, Costa Rica, and a female from Gatun, Panama. Length of body ♂ 9.8; ♀ 10.5, 9.7 and 8.8; length of pronotum ♂ 2; ♀ 2.2, 2 and 2: length of tegmen ♂ 2.7; ♀ 1.2, 1.2 and .8: total width of dorsal tegminal fields ♂ 2.4: length of caudal femur ♀ 8; ♀ 9.1, 7.7 and missing: width of caudal femur ♂ 2.2; ♀ 2.7, 2.2 and missing: length of ovipositor 7.1, 6 and 6.2 mm.

Specimens Examined: 13; 1 male, 3 females and 9 immature individuals.

La Emilia, near Guapiles, Costa Rica, 1000 feet, August 12, 20 and 24, 1923, (J. A. G. Rehn; beaten from low foliage in heavy forest), 1 ♂, 1 ♀, *type, allotype,* 2 juv. ♂, 1 juv. ♀, [A. N. S. P.].

Vesta Farm, Estrella Valley, Costa Rica, 200 feet, September 11, 1923, (J. A. G. Rehn; in dead leaves on floor of dense forest), 1 ♀ *paratype,* [A. N. S. P.].

Pandora Farm, Estrella Valley, Costa Rica, 100 feet, September 13, 1823, (J. A. G. Rehn), 1 juv. ♂, [A. N. S. P.].

Gatun, Canal Zone, Panama, July 12 to 15, 1916, (D. E. Harrower), 1 ♀, [Hebard Cln.].

Porto Bello, Panama, August 18 to 22, 1916, (D. E. Harrower), 1 juv. ♂, 4 juv. ♀, [Hebard Cln.].

PALPIGERA new genus

We erect this genus to include three species, *Luzara boliviana* Bruner, *Ectecous borellii* Giglio-Tos and *fratercula* here described, of which *borellii* was subsequently referred to *Luzara* and *Prosthacusta*. We select *Palpigera borellii* (Giglio-Tos) as genotype.

The remarkable lamellate expansion of the last two palpal joints constitutes a feature not shown by any other genus belonging to the present Group. The absence of transverse veins in the speculum of the male tegmina further differentiates *Palpigera* from any of the related genera in which that sex is known.

The genus is apparently nearest *Luzarida* here described, differing further in the pale distal palpal joints, stronger and different venation of the dorsal fields of the tegmina, broadly truncate apex of the male supra-anal plate and other less conspicuous features, given in the key.

Palpigera fratercula new species (Pl. VI, fig. 7; pl. VII, fig. 3.)

The unique type was recorded with a query as *Luzara rufipennis* by Bruner in 1916.

The present species is readily distinguished from the others of the genus by the characters given in the present key. In it the palpi and male supra-anal plate show the least specialization. The tegmina are smoother and their venation has a less irregular appearance than in either *P. borellii* (Giglio-Tos) or *P. boliviana* (Bruner).

Type: ♂; Santa Anna da Chapada, Matto Grosso, Brazil. October. (H. H. Smith.) [Carnegie Museum.]

The following characters are given in addition to those noted in the key. Body moderately robust, limbs rather short and heavy for the Group. Fastigium rounding into face at a right-angle, the latter almost evenly retreating. Lateral ocelli large, circular, very slightly closer to each other than to the larger, transversely elliptical median ocellus. Palpi as shown on plate VII, figure 3, least specialized of the known species of the genus. Tegmina much as in the other species, but smoother with veins less irregular; lateral fields with six unbranched veins. Wings absent. Supra-anal plate as shown on plate VI, figure 7; distinctly less specialized than in the other species of *Palpigera*.

Titillators largely concealed, apparently large and convoluted. Subgenital plate roundly trough-shaped, its lateral margins rounding into the broad and very weakly concave distal margin, its surface evenly convex except meso-distad toward the caudal margin where a trace of impression is shown. Auditory foramina of cephalic tibiae decidedly larger on cephalic than on caudal faces. Caudal tibia with four pairs of moderately alternating, short, stout spines, the teeth between and before very numerous, regular and large for the Group. Caudal metatarsus with two rows (including eight and eight) of similar but less closely placed teeth.

The most important features of color are given in the key. The antennae are dark brown, with very short, pale annuli. The palpi are dark brown proximad, the last joint and all but the base of the penultimate joint buffy.

Length of body 14.7, length of pronotum 3.1, length of tegmen 8.8, width of tegminal dorsal fields 6.6, length of caudal femur 15.1, width of caudal femur 3.9 mm.

Palpigera boliviana (Bruner) (Pl. VI, fig. 5; pl. VIII, fig. 2.)

1916. *Luzara boliviana* Bruner, Ann. Carnegie Mus., x, p. 388. [♂, ♀; Puerto Suarez, Bolivia.]

This species is not to be confused with *Amusus bolivianus* Giglio-Tos, a synonym of *P. borellii* (Giglio-Tos).

Through the kindness of the Carnegie Museum we are able to examine the original series of this interesting cricket, which proves to be generally extremely similar in size, structure and coloration to *P. borellii* (Giglio-Tos), differing particularly in the less highly specialized palpi and more highly specialized male subgenital plate. The characters given in the present key readily distinguish the material available of *boliviana* from that of *borellii*, but it is possible that additional series from other localities in Bolivia may show that geographic races of a single species are represented. Bruner, when describing *boliviana*, gave no comparisons, though material of *borellii* was also before him, and his original description of the present species omits its most distinctive features.

In additional to the originally described material there is before us a female from Urucum, Corumba, Brazil, taken December, 1919, by J. C. Bradley and in the author's collection.

This specimen is slightly darker than the other females and as dark as the males of the original series. Like in the paratypic female before us, the tegmina, which in the species of this genus are very loosely attached in this sex, have been lost.

Palpigera borellii (Giglio-Tos) (Pl. V, fig. 5; pl. VI, fig. 6; pl. VII, fig. 1.)

1897. *Ectecous borellii* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 302, p. 45. [♂, ♀; San Francisco and Caiza, Bolivia.]

1897. *Amusus bolivianus* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 302, p. 45. [[Juv.] ♀, ♀; San Francisco, Bolivia.]

1916. *Luzara borellii* Bruner, Ann. Carnegie Mus., X, p. 389. [♂, ♀; Santa Cruz de la Sierra and Provincia Sara, Bolivia.]

1918. *Prosthacusta borellii* Rehn, Trans. Amer. Ent. Soc., XLIV, p. 216. (Generic reassignment.)

A paratypic pair from San Francisco, Bolivia, is in the Academy Collection and Bruner's specimens are also before us, kindly loaned by the Carnegie Museum. Through the cooperation of Dr. A. Borelli, the author has just received a paratypic female of *Amusus bolivianus* Giglio-Tos, which shows beyond question the synonymy indicated above. As we had surmised, that name is based on immature material of *borellii*, representing a late instar in which rudimentary tegmina are developed. In such material these developing tegmina are thicker than is ever the case in adult material of the Group.

We find from the immature before us that the limbs, almost wholly dark and with scarcely or no trace of annuli in the adult, have the tibiae distinctly annulate in the early stages, the caudal femora with two oblique and very pale areas dorso-proximad and an extensive pale area, traversed by a dark line, ventro-proximad.

We have observed in other species of the Group more prominent annuli in the immature stages, indicating this to be a primitive feature.

Provincia Sara, Bolivia, 450 meters, (J. Steinbach). 1 ♂, 1 ♀, [Hebard Cln.].

The palpi are not quite as decidedly expanded in the San Francisco paratypes as in the balance of our series.

Face and lateral lobes of pronotum shining black. Occiput and fastigium deep russet, rarely with a suffused darker interocular bar. Disk of pronotum and dorsal fields of tegmina

russet, the latter usually slightly paler, tawny, the tegminal lateral fields always somewhat darker. Abdomen blackish with a russet tinge. Limbs the same but tibiae and cephalic and median femora except toward their bases deep russet, the caudal femora usually paling ventro-proximad and there sometimes buffy.

In coloration *P. boliviana* (Bruner) is apparently identical. The measurements of the paratypes before us are followed by those of the pair here recorded. Length of body ♂ 20.8 and 21.4, ♀ 21 and 22.4; length of pronotum ♂ 4.2 and 4, ♀ 4.7 and 4.7; length of tegmen ♂ 10 and 9.7, ♀ 5.8 and missing; total width of dorsal fields of tegmina ♂ 8 and 7.2; length of caudal femur ♂ 17.8 and 15.7, ♀ 16.2 and 17.5; width of caudal femur ♂ 4.8 and 4.3, ♀ 4.7 and 5; length of ovipositor 13.4 and 12 mm.

In this genus the irregular venation of the male dorsal tegminal fields is very different from that of any other of the Group, the speculum distorted, irregularly triangular and showing no veins whatever across it. The lateral ocelli are slightly less widely separated from each other than they are from the median ocellus. The ovipositor is straight or weakly curved dorsad, scarcely thicker than the shaft at base of acute apex but there distinctly deeper than wide.

LUZARIDA new genus

This genus is represented by three new species, two from Colombia and one from Trinidad, of which we select *annuliger* as genotype.

It is closely related to *Luzara* Walker, but a more primitive stock, readily distinguished by the characters given in the key.

Luzarida annuliger new species (Pl. VII, fig. 4; pl. VIII, figs. 2 and 3.)

This species occurs in the lowland forest of the Santa Marta region of Colombia, where it was found in company with two species of the genus *Luzara* Walker.

Its coloration renders it almost invisible when motionless in the dead leaves and litter of the forest floor.

Type: ♂; Aracataca, Magdalena, Colombia. August 13, 1920. (M. Hebard.) [Hebard Collection, Type No. 1097.]

The following characters are given in addition to those noted in the key. Size quite large, body moderately robust, limbs rather short for the Group. Fastigio-facial projection appre-

ciably more protuberant than in any of the species placed before *annuliger* in the present study. Lateral ocelli moderately large, circular, very slightly less widely separated from each other than from the slightly smaller, elliptical, median ocellus. Palpi elongate, ultimate joint with dorsal margin weakly concave, this becoming stronger meso-distad, the apical oblique truncation broadly convex and occupying very slightly over one-third the length of the joint. Tegmina moderately reduced for the Group, reaching cercal bases; dorsal fields elliptical but showing a weakly rectangulate tendency, almost flat with characteristic venation of the Group distinct but very delicately indicated in contour; mediastine vein with five (probably individually somewhat variable in number of branches) branches, the first branch proximal and branching again, the last two distal, short and oblique, three free veins below, so that in the lateral fields eight partially longitudinal veins or branches exist. Wings absent. Supra-anal plate bracket-shaped at apex and notched on each side opposite cercal bases. Titillators concealed. Subgenital plate cup-shaped with distal portions strongly bilobate, meeting mesad to form a narrow slit, before which the surface of the plate is broadly medio-longitudinally sulcate to a median point. Auditory foramina of cephalic tibiae on cephalic faces large and elliptical with surface of limb feebly concave beyond, on caudal faces slightly smaller and more elongate elliptical. Caudal tibiae with four pairs of strongly alternating, short spines, the teeth before and between very numerous, regular and large for the Group. Caudal metatarsus with two rows of similar, numerous teeth.

Allotype: ♀; same data as type. [Hebard Collection.]

Size larger. Tegmina more reduced, the dorsal fields weakly convex, considerably longer than wide, with numerous, rather delicate, quite regular, nearly longitudinal veins, of which the median branches distad, numerous irregular cross-veinlets indicated; lateral field with unbranched mediastine and four free veins. Ovipositor moderately elongate, slender, curved feebly dorsad, flattened dorsad toward the scarcely enlarged base of the aciculate apex, so that there it is very slightly wider than deep. Subgenital plate small, moderately bilobate.

Head clay color, all but occiput and fastigium heavily overlaid with blackish brown, the former with traces of four longitudinal broken stripes of bister; postocular region and lateral lobes of pronotum solidly blackish brown, the pronotal disk clay color irregularly flecked with bister. Palpi bister irregularly maculate with clay color, the ultimate joint blackish dis-

tad. Antennae buff with widely spaced annuli of bister, which are narrow proximad, becoming broad distad. Tegmina dorsad uniform snuff brown, the discoidal vein clay color; the lateral fields snuff brown becoming suffused with bister dorsad toward the discoidal vein. Abdomen bister. Cephalic and median limbs blackish brown, their tibiae and tarsi with striking but irregular buff annuli. Caudal femora snuff brown slightly mottled with darker and a broad, elongate, irregularly margined area of blackish brown dorsad on the external faces; tibiae snuff brown vaguely annulate with lighter and darker browns.

Length of body ♂ 16.1, ♀ 17.2; length of pronotum ♂ 3.4, ♀ 4.2; length of tegmen ♂ 10, ♀ 8; width of tegminal dorsal fields ♂ 7; length of caudal femur ♂ 13.7, ♀ 15.8; width of caudal femur ♂ 3.9, ♀ 4.3; length of ovipositor 12.7 mm.

Five immature individuals of the species were also taken by the author at the same locality from August 5 to 13, 1920[36]. These insects would remain motionless on the damp leaf litter in the twilight beneath the dense foliage of the high forest, where the ground was almost bare of vegetation, until closely approached, when they would spring about erratically with great power and speed.

It is probable that the secretive habitat, cryptic coloration and great agility explain why much fewer specimens of the Group are to be found, in collections from the regions where they occur, than would be expected were their actual numerical abundance known.

Luzarida pulla new species (Pl. VIII, fig. 1.)

This is a much darker insect than *L. annuliger* here described. It is known only from Muzo, a locality in an Andean valley of Orinocan drainage.

Type: ♂; Muzo, Boyacá, Colombia. 1921. (From A. Maria.) [Hebard Collection, Type No. 1098.]

The species is best distinguished from its allies by the characters given in the key. Size, form, limb length, ocelli, supra-anal plate, auditory foramina[37] and limb armament much as in *annuliger*. Fastigio-facial projection broader and slightly less protuberant. Palpi similar except that the dorsal margin of

[36] See color comments under *L. pulla* here described.

[37] These are malformed and only partially developed on one tibia.

the ultimate joint is even less concave. Tegmina more reduced, with three (instead of the usual two) veins crossing the speculum, these veins more transverse in trend. Distal portion of abdomen exposed. Titillators not enlarged distad, forming a chitinous cylinder, with distal lamellate fingers produced latero-ventrad and curved mesad. Subgenital plate of same type as in *annuliger,* but with distal bilobation even shorter and distal medio-longitudinal sulcus extending only one-third distance to base of plate.

Coloration shining blackish mummy brown, except as follows. Antennae with very short annuli and occiput with subobsolete longitudinal lines of buffy. Disk of pronotum with flecks of buffy which become numerous along the lateral margins. Humeral vein strikingly buffy and narrow area between it and discoidal vein less conspicuously buffy.

It is possible that we have here an exceedingly intensively colored individual of a species normally marked more as in *annuliger.* Additional material can alone decide this. The markings of *pulla* are, however, apparently more primitive, for very slender pale longitudinal lines on occiput and paler lateral margins of the pronotal disk are shown by the immatures but not the adults of *annuliger.*

Length of body 17, length of pronotum 3.2, length of tegmen 9.6, width of tegminal dorsal fields 7.4, length of caudal femur 12.2, width of caudal femur 4 mm.

Luzarida gracilior new species (Pl. VIII, figs. 4 and 5.)

The longer body and limbs and shorter tegmina and ovipositor, in addition to differences in coloration, separate this species from *L. annuliger* here described.

Type: ♀ ; Caparo, Trinidad, British West Indies. August, 1913. (S. M. Klages.) [Hebard Collection, Type No. 1099.]

Size quite large, body and limbs elongate for the genus. Fastigio-facial projection very slightly broader than in *annuliger,* equally protuberant. Ocelli similar except that the median is more narrowly elliptical, transverse, with a distinct impression along its ventral margin. Palpi as in *L. pulla* here described. Tegmina decidedly more reduced than in this sex of *annuliger,* with three (instead of four) more crowded, free veins below the unbranched mediastine vein in the lateral field. Ovipositor short and very slender when compared with body bulk, evenly cylindrical to the scarcely enlarged base of the sharp apex, there very slightly deeper than wide. Subgenital plate small, moderately bilobate. Limb armament as in *annuliger.*

Occiput deep mars brown with a pair of suffused buff longitudinal lines above each eye and three very narrow similar lines between[38]. Face and genae blackish mars brown with buffy flecks, one of these below each eye particularly large. Palpi suffused buffy, much marked with mars brown, the distal portion of the ultimate joint solidly mars brown. Antennae buffy proximad, thence mars brown with increasingly widely spaced very narrow annuli of buffy. Pronotal disk ochraceous buff heavily overlaid and tessellate with mars brown except along the lateral margins; lateral lobes blackish mars brown paling to russet within the margin ventro-cephalad. Tegmina cinnamon brown, with humeral vein buffy; lateral fields slightly darker between the slightly paler veins and veinlets. Abdomen prouts brown very finely, evenly and obscurely tessellate with suffused buffy. Cephalic limbs tawny with apices of femora and bases of tibiae mars brown preceded by a suffused annulus of the same. Median limbs missing. Caudal femora ochraceous buff tinged with orange externally proximo-dorsad and for a greater distance proximo-ventrad, the remaining portions blackish mars brown tessellate with buff to median portion dorsad and in ventral portion of external surface. Caudal tibiae mars brown with spines buffy and a trace of a pale proximal annulus.

The measurements of a paratypic female, from Trinidad, taken by A. Busck and belonging to the United States National Museum, follow those of the type. Length of body 20.7 and 16.7, length of pronotum 4.3 and 4, length of tegmen 6.2 and 5.7, length of caudal femur 16.7 and 15.2, width of caudal femur 4.2 and 4, length of ovipositor 9.2 and 9.2 mm.

LUZARA Walker

1869. *Luzara* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 103. Genotype, by monotypy.—*Luzara rufipennis* Walker.

1878. *Amusus* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXV, p. 419. Genotype, by monotypy.—*Amusus kirschianus* Saussure.

Under *rufipennis* we here note the synonymy of *kirschianus*, *Amusus* consequently falling as a synonym of *Luzara* through identity of genotypes.

The genus is readily distinguished from *Luzarida* here described by the smooth glabrous dorsal surfaces of the tegmina showing no veins whatever in contour and the lateral

[38] These are homologous to the intervals between the darker longitudinal areas of the occiput in *annuliger*, produced by the general recession of color pattern apparently normal in adults of that species.

fields of the tegmina less flaring with mediastine vein sending no short oblique veinlets to the costal margin distad.

The original description of *Luzara* gave no clue as to which category *rufipennis* belonged, so examination of the type was necessary before the genera could be characterized.

Luzara rufipennis Walker (Pls. IX and X.)

1869. *Luzara rufipennis* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 103. [♂, Colombia.]

1878. *Amusus kirschianus* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXV, p. 419. [♂, ♀; Venezuela.]

We have recently been able to study the type of *rufipennis* in the British Museum and the type of *kirschianus* in the Geneva Museum. After study of material before us and the notes on these specimens, we are satisfied that the synonymy indicated above is correct.

In the male type of *rufipennis* the tegminal lateral fields have six veins on one side and four on the other, one of which branches. The dark pronotum shows a moderate paling ventro-cephalad on the lateral lobes. The venation of the dorsal fields of the tegmina is not shown by contour but the stridulating and a lateral vein are indicated by buffy coloration. The jaws of this specimen are lengthy and apparently slightly more developed than is normal.

In a male from Venezuela, in the Geneva Museum, here selected as type of the synonymous *kirscianus*, the lateral fields of the tegmina have four and five veins, the ventral of which branches on each side. The dark pronotum shows a trace of paling ventro-cephalad on the lateral lobes.

In the series here recorded the lateral lobes of the pronotum vary individually from solidly dark to having the entire ventral portion pale, while the disk may be solidly dark, vaguely marbled or have suffused buffy lateral margins.

La Chorrera, Panama, May 9, 1912, (A. Busck), 1 ♀, [U. S. N. M.].

Hacienda Victoria, Sierra San Lorenzo, Magdalena, Colombia, 4100 feet, July 26, 1920, (Hebard; under banana stalks) 1 ♂, 2 ♀, [Hebard Cln.].

Minca, Magdalena, Colombia, 2500 feet, July 24, 1920, (Rehn and Hebard; found locally in dry dead leaves among low plants

of heavily forested ravine), 2 ♂, 1 ♀, [Hebard Cln. and A. N. S. P.].

Aracataca, Magdalena, Colombia, August 4 and 12, 1920, (Hebard; among dry dead leaves on ground of lofty lowland forest), 1 ♂, 2 ♀, [Hebard Cln.].

Loma Larga, northeast slope of Sierra Nevada de Santa Marta, Magdalena, Colombia, 2000 ft., (M. A. Carriker Jr.; in humid forest), 1 ♀, [Hebard Cln.].

The Panamanian female is smaller with tegmina showing more reduction than in the Colombian specimens. The insect was recorded from the Rio Lara, Darien, Panama, as the synonymous *Amusus kirschianus,* by Giglio-Tos, in 1897.

As this is one of the earliest known species of the Group, the following data is given to aid in placing it more definitely than is possible from the original description.

Palpi elongate, with distal joint having the dorsal margin quite decidedly concave and apical truncation occupying a full two-fifths of the length of the joint. Ocelli quite similar to those of *Luzarida annulipes* here described, but forming an equilateral triangle. Male tegmina showing more reduction than in that species, covering only about half the abdomen, their contour quite similar but the almost flat, glabrous dorsal surface shows scarcely any trace of venation through contour in either sex. Male subgenital plate even less strongly bilobate distad than in *Luzarida pulla* here described but with a deep distal medio-longitudinal sulcation reaching a median point. Ovipositor weakly curved dorsad, with base of acute apex scarcely at all thickened and there slightly deeper than wide.

General coloration (intensive) shining blackish brown, the femora proximad and tegmina, particularly in dorsal fields, slightly paler, liver brown, the narrow area between the discoidal and humeral veins dull ochraceous tawny. Antennae liver brown with widely separated, very short annuli of buff. Palpi buffy much suffused with dark brown, this covering all of the apical portion of the ultimate joint. In more recessive examples the general coloration is mars brown with disk of pronotum and tegmina russet, the caudal femora shading proximad through russet to tawny. In recessive females the lateral lobes of the pronotum are defined from the disk by a suffused line of tawny or even of buffy, these lines sometimes dividing briefly toward the caudal margin of the pronotum. In these some

of the veins of the dorsal fields of the tegmina are buffy, particularly laterad, while the darker coloration of the external surfaces of the caudal femora sometimes breaks up into numerous very narrow vague oblique bands [39].

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Width of dorsal fields of tegmina	Length of caudal femur	Width of caudal femur	Length of ovipositor
♂							
Aracataca, Colombia ...	21.4	4.7	9.7	7.8	16.2	4.9	——
Colombia. *Type* [40]	21.5	——	9	7	18	6	——
Minca, Colombia	23.5	4.8	9.7	8.2	17.4	5.3	——
♀							
La Chorrera, Panama ..	18	4.4	5.3	——	14.2	4.3	12.5
Aracataca, Colombia ...	20.2	4.7	7.4	——	16	4.8	13.1
Loma Larga, Colombia.	18.2	4.9	8.2	——	16.3	4.9	13.8

Individuals of this species were found to leap powerfully, but they were not as rapid in their movements as was the Gryllomorphid *Odontogryllus setosus* Saussure, a cricket found in similar environment at a higher elevation on Sierra San Lorenzo, above Minca, in the Santa Marta Region of Colombia.

Luzara minor new species (Pl. XI, figs. 1 and 2.)

This may be the depauperate adaptation of *L. rufipennis* Walker to some special environmental condition. As both occur at the same locality, it can not be considered a geographic race. Though of much smaller size, it otherwise is indistinguishable except by features which usually have little specific value.

The five males before us are slightly darker in general coloration than those of *rufipennis*, with the darker, glabrous and scarcely convex dorsal surface of the tegmina scarcely showing even traces of venational contour but bounded very narrowly not only laterad but caudad with ochraceous buff, often tinged with tawny.

[39] A tendency toward this condition is shown by Walker's type, originally described as having black oblique streaks on the caudal femora.

[40] These measurements were very kindly taken for us by Mr. B. Uvarov.

Type: ♂; Aracataca, Magdalena, Colombia. August 3, 1920. (M. Hebard.) [Hebard Collection, Type No. 1101.]

Agrees closely with *rufipennis* except as noted above. Structurally generally similar. Head and pronotum deep russet, the latter shading to mars brown on the disk and with lateral lobes of that color. Tegmina and caudal limbs almost black but with a weak mars brown tinge, the former marked as described above, the caudal femora gradually paling (this shown by the series, however, to be true only for recessive examples) proximad to russet. Cephalic and median limbs mars brown paling to russet proximad, their metatarsi (as in *rufipennis*) buffy proximad. Palpi and antennae as in that species.

Allotype: ♀; same data as type but taken August 11, 1920. [Hebard Collection.]

Similar to *rufipennis* except in the much smaller size. Pronotal coloration as described for females of that species. Tegmina with veins and veinlets of dorsal fields buffy but scarcely indicated in contour, this coloring more distinct along the lateral margins.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of tegmen	Width of tegminal dorsal fields	Length of caudal femur	Width of caudal femur
Santa Marta. *Paratype* .	12.8	2.8	6.9	5.9	11	3.2
Aracataca. *Type*	11.8	2.7	6.8	5.8	10.8	3
Aracataca. *Paratypes*(3)	10.9-12.7	2.7-2.8	6.4-6.8	5.2-5.8	10-10.6	2.9-3.1
♀				Length of ovipositor		
Aracataca. *Allotype* ...	14.1	3.1	4.2	9.2	11.3	3.2
Aracataca	17	4.1	5.7	10.7	13.9	4.3

The second female from Aracataca is apparently unusually large for *minor*, while that from La Chorrera, Panama, assigned to *L. rufipennis* Walker, is small for that species. All of the other specimens of these species before us can be easily separated by the decided difference in size.

Specimens Examined: 7; 5 males and 2 females.

Santa Marta, Magdalena, Colombia, October, 1917, (M. A. Carriker, Jr.), 1 ♂, *paratype*, [Hebard Cln.].

Aracataca, Magdalena, Colombia, August 3 to 11, 1920, (M. Hebard), 4 ♂, 2 ♀, *type, allotype, paratypes*, [Hebard Cln.].

Two males and one female, including the type and allotype were found on the ground between rows of sugar cane debris, in a region of low, dense, wet brush. The others were secured in a lofty lowland forest, where they lived in the dead leaves on the ground. In that environment we also found *Lerneca varipes* Walker, *Lazurida annuliger* here described and *Luzara rufipennis* Walker.

AMUSODES new genus

We designate as genotype *festae* of Giglio-Tos, a species originally referred to *Amusus*, which is now known to be a synonym of *Luzara*. The characters of major importance in distinguishing it from that genus are the more slender form, unusually elongate limbs for species of the present Group and more rostrate fastigium [41].

Unfortunately *festae* and two other species described here are known only from females, a third new species only from a male. Moreover, although the Costa Rican *estrellae* is unquestionably congeneric with *festae*, the British Guianan *albifrons* has a blunter and broader fastigium with lateral ocelli slightly more widely separated, while the Peruvian *andeanum* has a decidedly more rostrate fastigium with lateral ocelli decidedly more closely placed. Such differences are not found in species of the same genus elsewhere in the Group, but the agreement in auditory foramina, palpi, tegminal development and venation and ovipositor is so close that, with these added to the other characters given above for *Amusodes*, it seems best to consider these species congeneric.

Discovery of both sexes of the four species in question may, however, show that three distinct genera are represented.

Amusodes albifrons new species (Pl. XI, fig. 3.)

The dark general coloration, annulate limbs and strikingly pale occiput and fastigium readily separate this species from any other of the Group.

Type: ♂; Kartabo, Bartica District, British Guiana. June 22, 1919. (Wm. Beebe.) [A. N. S. P., Type No. 5438.]

[41] Of the species assigned here, *albifrons* does not agree in this feature.

Size and form medium for the Group, of approximate size but much more slender than *Luzara minor* here described. Ocelli elliptical, of moderate size for the Group, the lateral very slightly more widely separated from each other than from the median, where weak impression is shown about its margins. Ultimate joint of palpi with dorsal margin moderately concave, apical oblique truncation occupying about two-fifths length of joint. Tegmina reduced, covering over half of abdomen and hardly wider than the pronotum, the dorsal fields forming a rectangle with rounded latero-caudal angles. Supra-anal plate with emarginations opposite cercal bases, thence with sides briefly convergent, the broad apex truncate but very weakly obtuse-angulate produced. Subgenital plate scoop-shaped, broadly truncate distad, its surface without impression or sulcus. Auditory foramina of cephalic tibiae on cephalic face large, elliptical, with an extensive impressed area beyond; on caudal face small, irregularly elliptical, atrophied. Caudal limbs missing.

General coloration shining blackish brown, slightly paler and deep chestnut on tegmina and mesad on pronotum. Abdomen obscurely tessellate with ochraceous tawny. Head and palpi blackish chestnut brown, with occiput, fastigium and middle portions of face strikingly light ochraceous buff, the face mesad with a dark inverted V. Cephalic and median limbs ochraceous tawny, the femora with three annuli which are increasingly distinct distad, the tibiae proximad, mesad and distad and the tarsi distad cinnamon brown.

Length of body 12.4, length of pronotum 3.3, length of tegmen 5, width of dorsal fields of tegmen 4, length of cephalic femur 5.1 mm.

Amusodes estrellae new species.

This insect is closely related to *Amusodes festae* (Giglio-Tos) differing in its larger size, more uniformly dark coloration and proportionately slightly shorter ovipositor.

More material would aid in establishing the features of constant difference and is particularly needed in the present case as we realize that the two females before us of *festae* show more individual variation than is usual in the species of the Group.

Type: ♀; Vesta Farm, Estrella Valley, Costa Rica. Elevation 200 feet. September 11, 1923. (J. A. G. Rehn.) [A. N. S. P., Type No. 5449.]

The following characters are given in addition to those noted in the key. Ocelli forming an equilateral triangle, the lateral ocelli thus very slightly more widely separated than in *festae*. Fastigium slightly broader at apex than in that species. Palpi similar, very elongate, the ultimate joint distinctly longer than third, ultimate joint with dorsal margin broadly concave (this strongest meso-distad), the apical oblique truncation broadly convex and occupying distinctly less than one-third the length of the joint. Tegmina conspicuously shorter than pronotum, narrowly overlapping; the convex costal margin curving broadly into the broadly convex distal margin, which curves less broadly into the short sutural margin; two free veins moderately arcuate, mediastine and discoidal veins prominent, humeral vein weakly indicated distad, other veins of dorsal fields not indicated by contour but visible in some lights. Ovipositor as in *festae*, curving fairly strongly dorsad to the lanceolate apex which is horizontal and broader than wide at its base. Subgenital plate small, with weakly concave distal margin which, however, appears U-emarginate in caudal aspect.

General coloration claret brown, deeper on head and pronotum, mere traces of paler occipital lines suggested. Palpi buffy generally suffused with cinnamon brown. Antennae blackish, with very minute, widely separated, inconspicuous buff annuli. Tegmina with veins which are indicated by contour buffy. Abdomen showing dorsad weak paler tessellation, this morocco red on claret brown. Cephalic and median limbs hays russet with traces of mahogany red (slightly deeper) annuli. Caudal femora claret brown distad with a trace of pre-genicular annulation, then mahogany red paling to sanfords brown proximad. Caudal tibiae claret brown with spines, spurs and a proximal annulus paler, mahogany red.

The contrast between this much more reddish and uniform coloration and the cinnamon brown and buffy, heavily annulate, *festae*, is not as extreme as might be supposed. The color pattern, except for dark pronotal lateral lobes, is almost exactly the same except that all is deeper, greatly suffused with occipital bars and limb annuli almost obliterated.

Length of body 21.3, length of pronotum 5, length of tegmen 3.8, length of cephalic femur 8.8, length of caudal femur 18.3, greatest width of caudal femur 4.9, length of ovipositor 12.2 mm.

Amusodes festae (Giglio-Tos) (Pl. XII.)

1897. *A* [*musus*] *festae* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 301, p. 6. [♀; Punta di Sabana, Darien, [Panama].]

Gatun, Canal Zone, Panama, July 17 to 30, 1916, (D. E. Harrower), 1 juv. ♀, 1 very small juv.; August 6 to 22, 1916, (D. E. Harrower), 1 ♀, [all Hebard Cln.].

Porto Bello, Panama, August 18 to 22, 1916, (D. E. Harrower), 2 juv. ♀, [Hebard Cln.].

Gold Hill, Canal Zone, Panama, November 14, 1913, (M. Hebard; in dead leaves under bushes overgrown with vines), 1 small juv., [Hebard Cln.].

Andagoya, Antioquia (Chocó), Colombia, April 22, 1918, (M. A. Carriker, Jr.), 1 ♀, 1 small juv., [Hebard Cln.].

The adult male of this handsome species is still unknown. Supplementing the original description, other characters of apparent value are given here in comparisons in the discussion of the closely related *A. estrellae* here described.

Though generally paler than the Gatun female, that from Andagoya has the lateral lobes of the pronotum as dark as the disk except for a buffy ventro-cephalic spot, while in form it is more slender with longer tegmina and limbs. So similar is it in all other respects that we do not believe that a geographic race of the Colombian Chocó should be recognized without sufficient adult material to detect the degree of individual variation in these features which may occur in the species.

The measurements of the Gatun individual are given first. Length of body 14.7 and 14.7, length of pronotum 3.9 and 3.9, length of tegmen 4.1 and 4.6, length of cephalic femur 7.7 and 7.8, length of caudal femur 14.8 and 16.8, greatest width of caudal femur 3.8 and 3.8, length of ovipositor 13.3 and 15.8 mm.

Amusodes andeanum new species

1913. *Amusus kirschianus* Caudell (not of Saussure, 1878), Proc. U. S. Nat. Mus., XLIV, p. 357. [♀; Pampaconas River, Peru.]

1918. *Amusus kirschianus* Caudell (not of Saussure, 1878), Insec. Inscit. Menstr., VI, p. 66. [♀, juv; 75°17′W, 11°3′S.]

The present insect, though agreeing more closely in general appearance with *Amusodes festae* (Giglio-Tos) than with any other species, is actually quite widely separated by the char-

acters given in the present key, which we have remarked may prove to be indices of generic value, when males of these species have been discovered.

A decided amount of agreement with *festae* in markings is found in *andeanum,* this species like *Amusodes estrellae* here described being darker, but the opposite of that insect in having the pale occipital lines and antennal annuli even more conspicuous than in *festae.*

Type: ♀; 75°17′W, 11°3′S, central Peru. November 14, 1906. (N. Ikonnicoff.) [U. S. N. M.]

The following features are noteworthy in addition to the characters given in the key. Palpi much as described for *estrellae,* but very slightly less elongate. Tegmina very slightly longer than pronotum, the lateral fields more vertical than in *estrellae* or *festae* and sharply defined from the smooth shining and weakly convex dorsal fields by the decided humeral vein, simple mediastine and three (or two in paratype) free veins (two of which fuse on one side but not on the other in both specimens before us) nearly as prominent; longitudinal veins of dorsal fields distinct in some lights and then seen to be connected by a network of cross-veinlets; free margin of lateral field broadly convex, distal margin of dorsal field curving broadly into sutural margin at about ninety degrees. Ovipositor not curving as strongly dorsad as in *estrellae* or *festae* and unlike those species with apical portion continuing this curvature, with apex very little enlarged proximad and there as deep as wide. Subgenital plate as described for *estrellae.*

Head, sides of pronotum and lateral fields of tegmina shining black with a maroon tinge, occiput with four percurrent longitudinal lines of warm buff, lateral lobes of pronotum with a minute buffy fleck ventro-cephalad in paratype. Antennae and palpi blackish liver brown, the former with small widely spaced but striking annuli of light buff, the latter with two distal joints narrowly buffy distad. Dorsal surface of pronotum nearly as dark as lateral lobes but disk marbled with slightly lighter, dull claret brown. Dorsal fields of tegmina uniform dull claret brown, the humeral vein buffy, this not shown in paratype. Abdomen carob brown, faintly tessellate dorsad with a slightly paler shade. Femora kaiser brown proximad deepening to deep carob brown distad, the tibiae deep carob brown.

The paratypic female from the Pampaconas River, Peru, taken in August, 1911, is measured last. Not only is this specimen smaller but it has the cephalic and median femora and tibiae

blackish with short, very conspicuous buff annuli. This is a very decided difference in coloration, but the absence of such annuli in the type may be due solely to intensification. Additional material may, however, show that a distinct geographic race is represented. Length of body 17.4 and 14.1, length of pronotum 4 and 3.8, length of tegmen 4.6 and 4.3, length of cephalic femur 7.7 and 7, length of caudal femur 16.8 and 14.8, greatest width of caudal femur 4.3 and 4, length of ovipositor 15.8 and 13.3 mm.

MEGALAMUSUS new genus

This genus is erected to include a single new species from the inaccessible Casenare region of Colombia. It is characterized by the features given in the key.

Megalamusus casenare new species (Pl. XIII.)

This large and quite uniformly dark brown species is readily separated from all others here discussed by its large size, elongate limbs, more projecting eyes, narrower and more rostrate fastigium and less widely separated lateral ocelli.

It is clearly a type diverging strongly toward the Group Heterogrylli, but of the described genera, we believe it to be nearest *Amusodes* here described, showing greatest affinity to the longer limbed species there included.

Type: ♀ ; Palmar, Rio Casenare, Santander, Colombia. April 1917. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1100.]

Size very large, form medium, limbs elongate for the Group. Lateral ocelli circular and somewhat larger proportionately than in the preceding species, distinctly closer to each other than to the very large, transversely elliptical median ocellus, which is bounded ventrad by a shallow sulcus. Palpi very elongate and slender, the ultimate joint with dorsal margin rather broadly concave, the convex apical oblique truncation occupying one-third the length of the joint [42]. Occiput with weak impressions, pronotal disk with distinct impressions. Tegminal reduction much as in *Amusodes festae* (Giglio-Tos) ; structure corneous, longitudinal veins of dorsal fields very weakly but distinctly

[42] The enlarged distal portion less expanded and more elongate than in *Amusodes festae* (Giglio-Tos), where the apical oblique truncation occupies only slightly over a quarter the length of the joint.

indicated in contour, some of these forking, transverse veinlets obsolete; humeral vein sharply delimiting the vertical lateral fields which include the regular, unbranched mediastine vein and (two on one side, three on the other) similar free veins. Ovipositor very elongate and moderately heavy for the Group, curving considerably dorsad; the apex not thickened proximad where it is slightly deeper than wide, its margins thence exceedingly faintly convex to the acute apex. Subgenital plate small, truncate distad in ventral aspect, appearing U-emarginate in caudal aspect. Limbs much as in *Amusodes festae* but with spines of caudal tibiae much more strongly alternating. Caudal femora elongate, robust proximad but with much more slender distal portion of even width more extensive. Caudal tibiae slender, the four pairs of spines very strongly alternating and the teeth very numerous and extending far proximad on both dorsal margins. Elongate and slender caudal metatarsus with more numerous teeth on dorso-external than on dorso-internal margin.

General coloration rich, shining chestnut brown; deeper on occiput and pronotum (cephalad and mesad on disk and meso-cephalad on lateral lobes), becoming blackish on femora distad. Antennae and cerci buckthorn brown, the latter paling so that more than distal half is light ochraceous buff. Palpi solidly prouts brown, becoming paler proximad. Pronotal lateral lobes ventro-cephalad ochraceous buff tinged with tawny below darker area. Tegmina tawny laterad with veins chestnut brown. Femora dorso-proximad paling to ochraceous tawny, the caudal femora externally with a moderately broad longitudinal zone of ochraceous buff which gradually narrows to disappear near end of enlarged portion.

Length of body 26.2, length of pronotum 6, length of tegmen 7.1, length of caudal femur 25, greatest width of caudal femur 5.2, length of cercus 28.5, length of ovipositor 23.8 [43] mm.

ANACUSTA new genus

This genus includes a single new species which was found at nine thousand feet on the Eastern slope of the Andes, in Santander, Colombia.

Though known only from the female sex, sufficient characters are shown, as given in the key, to warrant description.

Anacusta micans new series (Pl. VI, fig. 8.)

This richly colored and finely striped and tessellate cricket is, in the female sex, apterous and particularly distinguished

[43] This is taken in direct line from base to apex, if the ovipositor were straight the dimension would consequently be materially greater.

by the somewhat Amphiacustine appearance, though the limbs are much shorter and their armament agrees with the type usual for the Group Luzarae.

Type: ♀; La Pica, Santander, Colombia. Elevation 9000 feet. February 10 to 15, 1917. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1093.]

Size, form and limb length medium for the Group. Fastigium broad, not at all rostrate, the projection formed by it and the face weak. Lateral ocelli of moderate size, circular, separated slightly more from each other than from the smaller, circular median ocellus, which is bounded ventrad by a very fine sulcus. Palpi short, the ultimate joint decidedly expanded with dorsal margin and apical oblique truncation straight, the latter occupying nearly three-fifths the length of the joint. Pronotal lateral lobes flaring sufficiently ventrad so that the ventrocephalic angles are clearly visible from above, these, though broadly convex, showing more of an angulate tendency than in the other species of the Group. Organs of flight absent. Ovipositor slender, of medium length, curved very feebly dorsad, the apex hardly enlarged but with sides more convex proximad, there of about equal width and depth, thence tapering evenly to the aciculate extremity. Subgenital plate small, truncate distad in ventral aspect, appearing U-emarginate in caudal aspect.

General coloration bright ochraceous tawny, overlaid with darker browns as follows. Head chestnut brown with narrow supra-lateral ocellar and supra-ocular longitudinal lines of ochraceous tawny on occiput and a broader longitudinal line of the same below the median ocellus which broadens ventrad to include all of the clypeus, the genae also ochraceous tawny. Palpi buffy with proximal and distal portions of third, all (or part) of fourth and proximal half of fifth (ultimate) joints dark brown. Pronotal disk tawny with blackish brown suffusions, particularly caudad along a fine pale median line and lateral lobes solidly blackish brown. Abdomen with the same very fine pale medio-longitudinal line, mesonotum and metanotum heavily suffused elsewhere with blackish brown, these lateral markings breaking on the tergites into an intricately dotted and tessellate pattern. Limbs dull ochraceous tawny, the cephalic and median femora distad with a paler annulus flanked by conspicuous annuli of prouts brown, such markings indicated only internally on the caudal femora, their external faces weakly

PLATE I

Fig. 1. *Lernecella trinitatis* new species. Dorsal outline of male. *Paratype.* Carenage, Trinidad. (X 4)

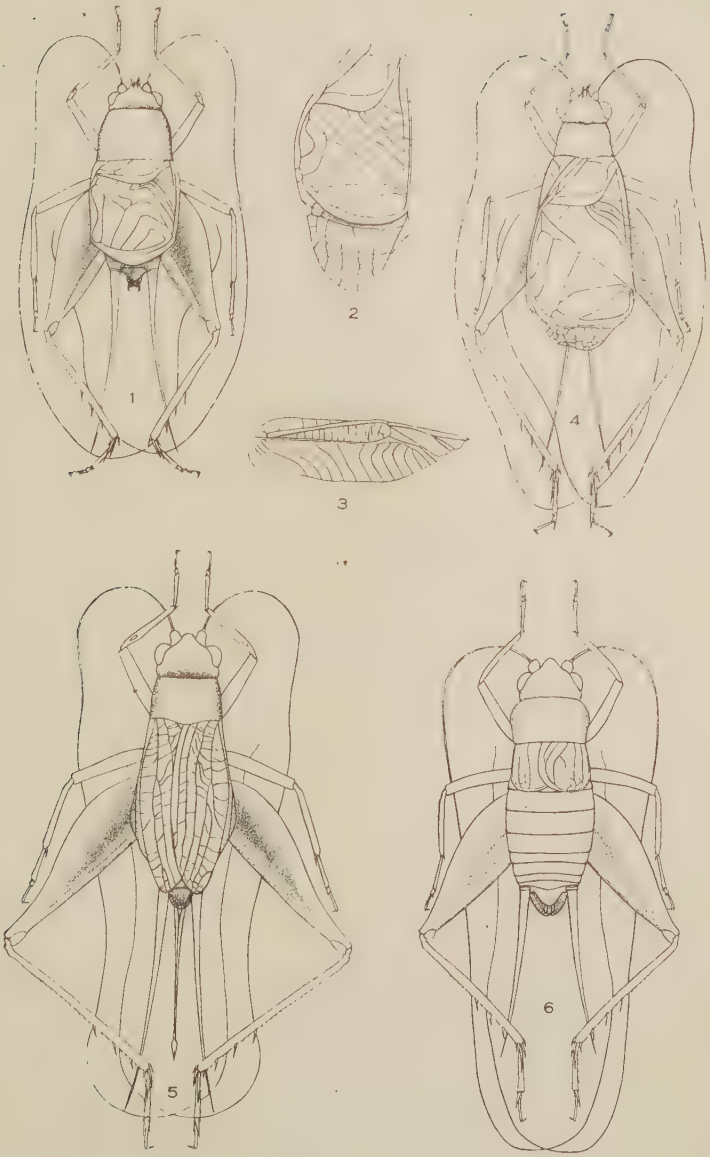
Fig. 2. *Lerneca funebris* new species. Dorsal field of male dextral tegmen. *Paratype.* Mouth of Rio Teffe, Brazil. (X 4)

Fig. 3. *Lerneca funebris* new species. Lateral field of male sinistral tegmen. *Paratype.* Mouth of Rio Teffe, Brazil. (X 4)

Fig. 4. *Lerneca varipes* Walker. Dorsal view of male. France Field, Canal Zone, Panama. (X 4)

Fig. 5. *Lerneca varipes* Walker. Dorsal view of female. Caparo, Trinidad. (X 4)

Fig. 6. *Cophella rehni* new species. Dorsal view of male. *Type.* Morces Gap, Blue Mountains, Jamaica. (X 4)



HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

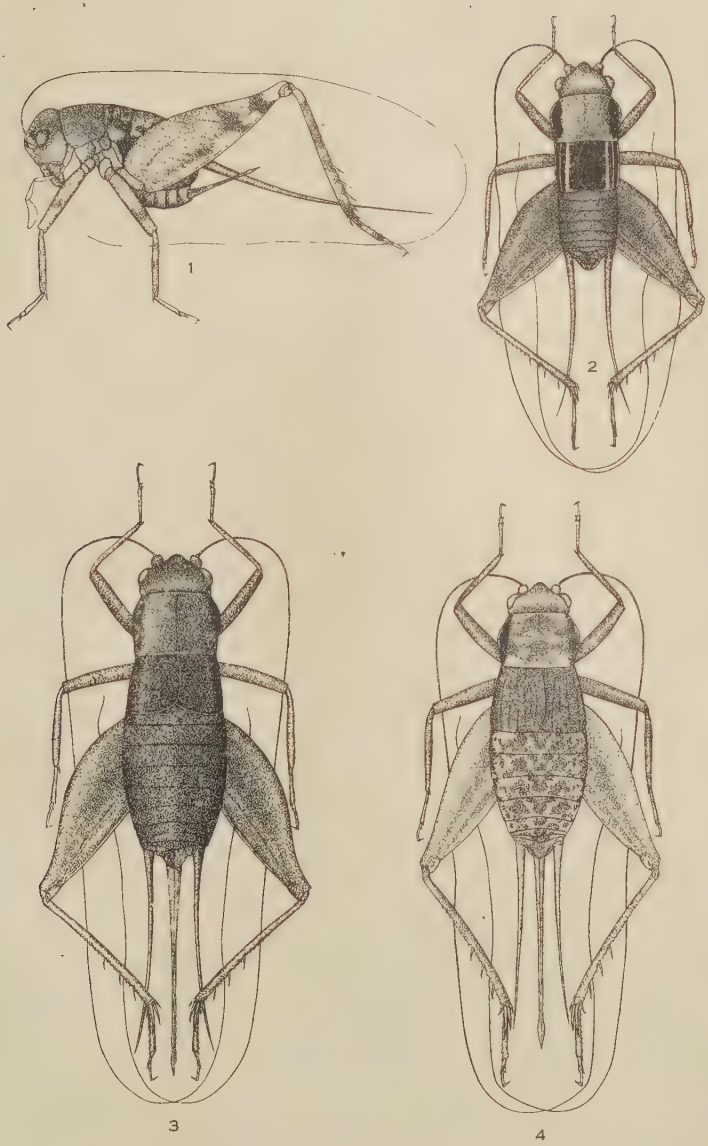
PLATE II

Fig. 1. *Miogryllodes panamae* new species. Lateral view of female. *Type.* Porto Bello, Panama. (X 3)

Fig. 2. *Cophella formosa* new species. Dorsal view of male. *Type.* Stony Hill, Jamaica. (X 4)

Fig. 3. *Cophella rehni* new species. Dorsal view of female. *Allotype.* Morces Gap, Blue Mountains, Jamaica. (X 4)

Fig. 4. *Cophella picta* new species. Dorsal view of female. *Type.* Rio Seco, Guantanamo, Cuba. (X 4)



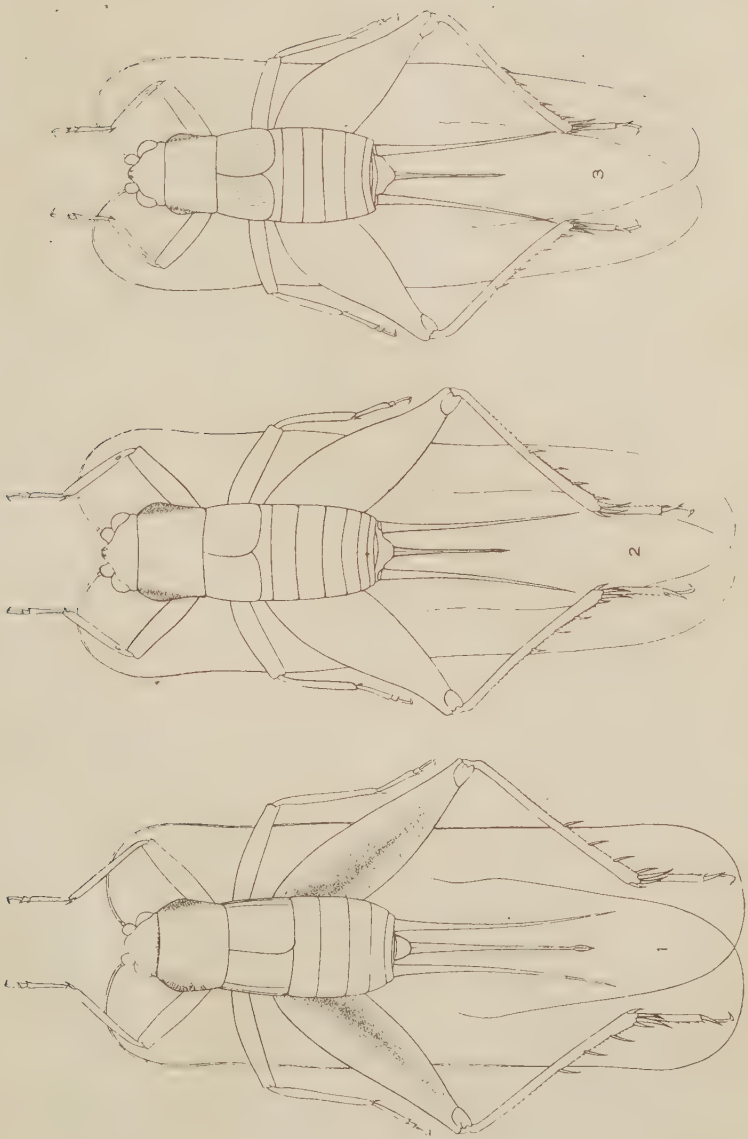
HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

PLATE III

Fig. 1. *Paracophella caribbea* new species. Dorsal outline of female. *Type.* Laudet, Dominica. (X 3)

Fig. 2. *Gryllosoma esau* new species. Dorsal outline of female. *Allotype.* Porto Bello, Panama. (X 3)

Fig. 3. *Gryllosoma choco* new species. Dorsal outline of female. *Type.* Andagoya, Antioquia, Colombia. (X 3)



HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

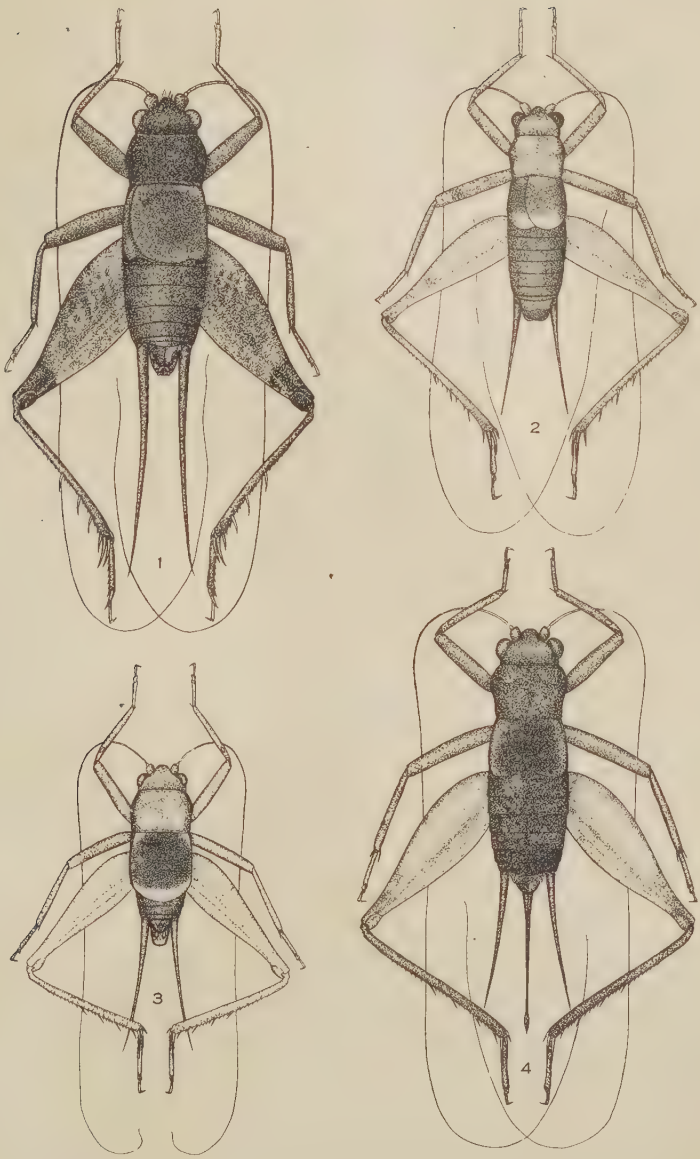
PLATE IV

Fig. 1. *Gryllosoma esau* new species. Dorsal view of male. *Type.* Porto Bello, Panama. (X 3)

Fig. 2. *Prosthama tessellata* new species. Dorsal view of male. *Type.* La Emilia, Costa Rica. (X 3)

Fig. 3. *Tairona pulchella* new species. Dorsal view of male. *Type.* Hacienda Cincinnati, Sierra San Lorenzo, Colombia. (X 3)

Fig. 4. *Tairona pulchella* new species. Dorsal view of female. *Allotype.* Hacienda Cincinnati, Sierra San Lorenzo, Colombia. (X 3)



HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

Plate V

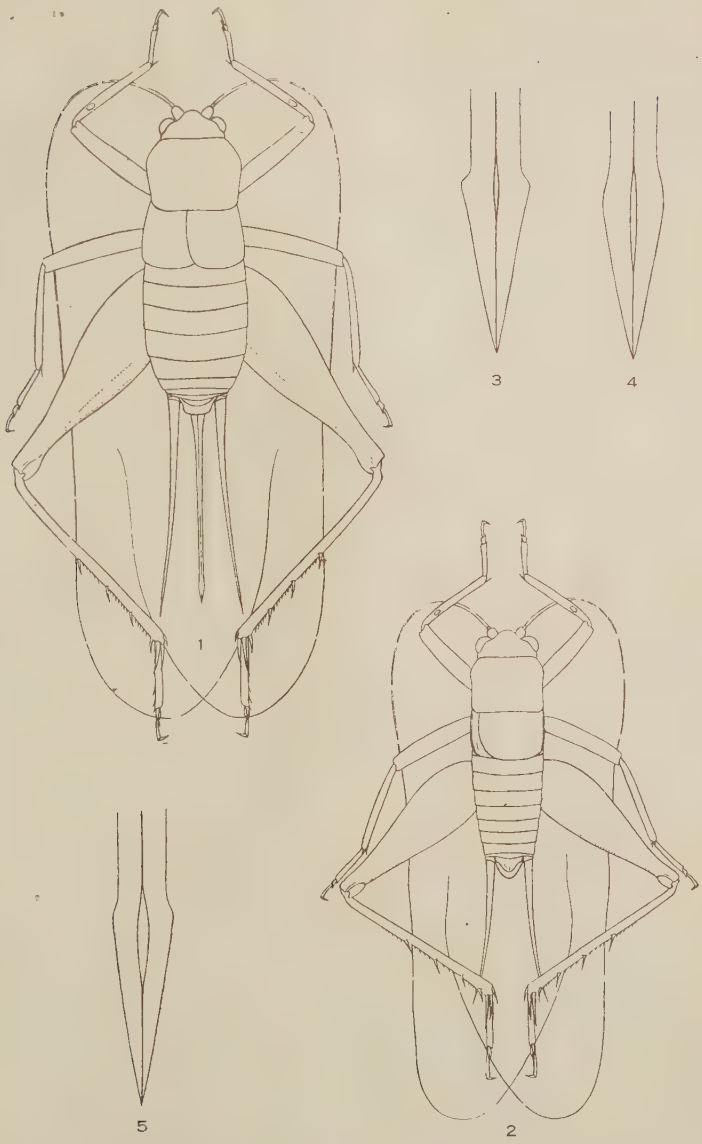
Fig. 1. *Rehniella glaphyra* new species. Dorsal outline of female. *Allotype.* Between Cervantes and Pacayas, Costa Rica. (X 3)

Fig. 2. *Rehniella glaphyra* new species. Dorsal outline of male. *Type.* La Palma, between Irazú and Barba Volcanoes, Costa Rica. (X 3)

Fig. 3. *Prosthama tessellata* new species. Dorsal outline of apex of ovipositor. *Paratype.* Vesta Farm, Estrella Valley, Costa Rica. (Greatly enlarged.)

Fig. 4. *Tairona pulchella* new species. Dorsal outline of apex of ovipositor. *Allotype.* Hacienda Cincinnati, Sierra San Lorenzo, Colombia. (Greatly enlarged.)

Fig. 5. *Palpigera borellii* (Giglio-Tos). Dorsal outline of apex of ovipositor. Provincia Sara, Bolivia. (Greatly enlarged.)



HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

PLATE VI

Fig. 1. *Rehniella glaphyra* new species. Dorsal view of male supra-anal plate. *Type.* La Palma, between Irazú and Barba Volcanoes, Costa Rica. (Greatly enlarged.)

Fig. 2. *Prosthama tessellata* new species. Dorsal view of male supra-anal plate. *Type.* La Emilia, Costa Rica. (Greatly enlarged.)

Fig. 3. *Tairona pulchella* new species. Dorsal view of male supra-anal plate. *Type.* Hacienda Cincinnati, Sierra San Lorenzo, Colombia. (Greatly enlarged.)

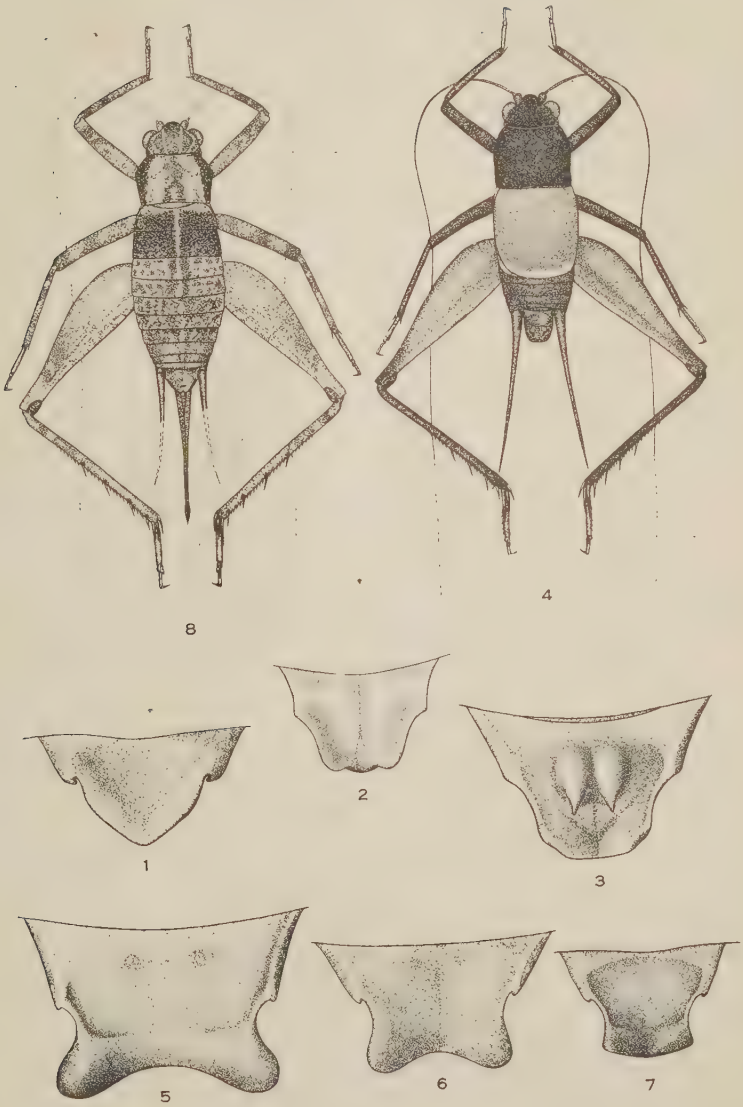
Fig. 4. *Niquirana polita* new species. Dorsal view of male. *Type.* Guatemala. (X 3)

Fig. 5. *Palpigera boliviana* (Bruner). Dorsal view of male supra-anal plate. *Type.* Puerto Suarez, Bolivia. (Greatly enlarged.)

Fig. 6. *Palpigera borellii* (Giglio-Tos). Dorsal view of male supra-anal plate. Provincia Sara, Bolivia. (Same scale as figure 5.)

Fig. 7. *Palpigera fratercula* new species. Dorsal view of male supra-anal plate. *Type.* Santa Anna da Chapada, Matto Grosso, Brazil. (Same scale as figure 5.)

Fig. 8. *Anacusta micans* new species. Dorsal view of female. *Type.* La Pica, Santander, Colombia. (X 3)



HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

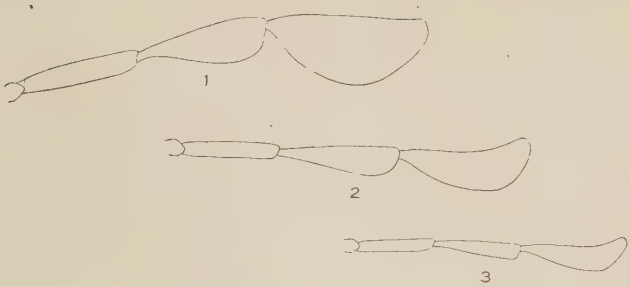
Plate VII

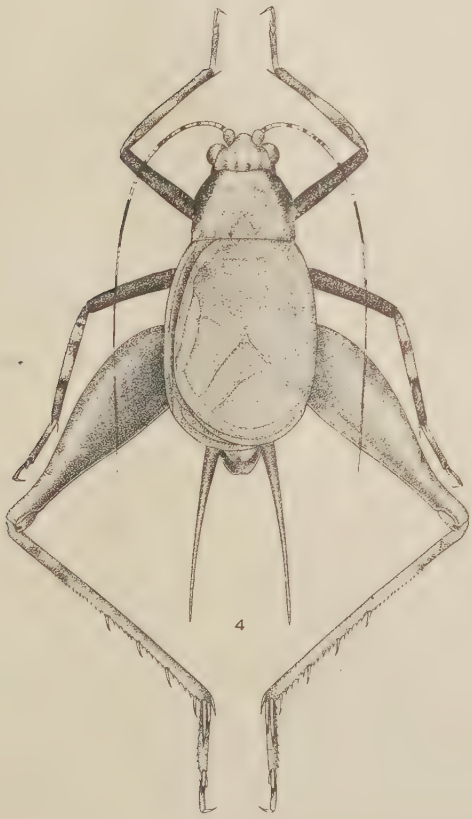
Fig. 1. *Palpigera borellii* (Giglio-Tos). Lateral outline of palpus. Female. Provincia Sara, Bolivia. (Greatly enlarged.)

Fig. 2. *Palpigera boliviana* (Bruner). Lateral outline of palpus. Male. *Type.* Puerto Suarez, Bolivia. (Same scale as figure 1.)

Fig. 3. *Palpigera fratercula* new species. Lateral outline of palpus. Male. *Type.* Santa Anna da Chapada, Goyaz, Brazil. (Same scale as figure 1.)

Fig. 4. *Luzarida annuliger* new species. Dorsal view of male. *Type.* Aracataca, Magdalena, Colombia. (X 3)





HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

Plate VIII

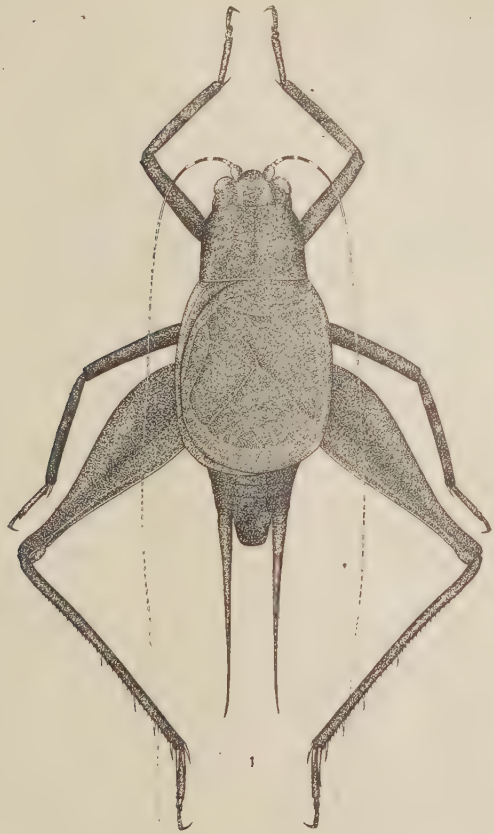
Fig. 1. *Luzarida pulla* new species. Dorsal view of male. *Type.* Muzo, Boyacá, Colombia. (X 3)

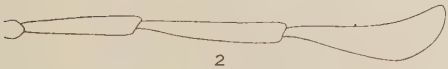
Fig. 2. *Luzarida annuliger* new species. Lateral outline of palpus. Female. *Allotype.* Aracataca, Magdalena, Colombia. (Greatly enlarged.)

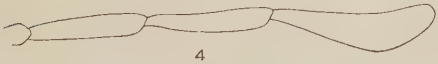
Fig. 3. *Luzarida annuliger* new species. Dorsal outline of sinistral female tegmen. *Allotype.* Aracataca, Magdalena, Colombia. (X 4)

Fig. 4. *Luzarida gracilior* new species. Lateral outline of palpus. Female. *Type.* Caparo, Trinidad. (Greatly enlarged.)

Fig. 5. *Luzarida gracilior* new species. Dorsal outline of sinistral female tegmen. *Type.* Caparo, Trinidad. (X 4)



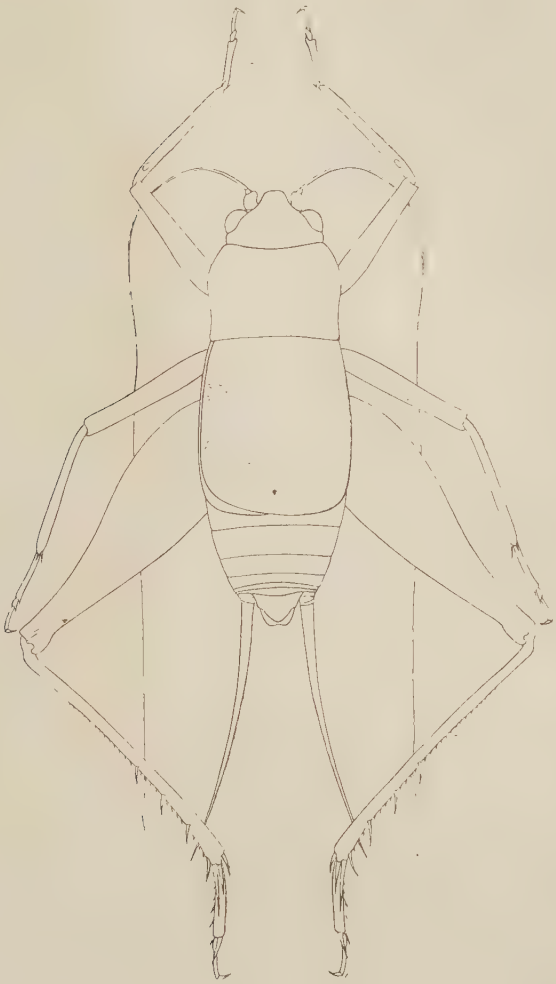




HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

PLATE IX

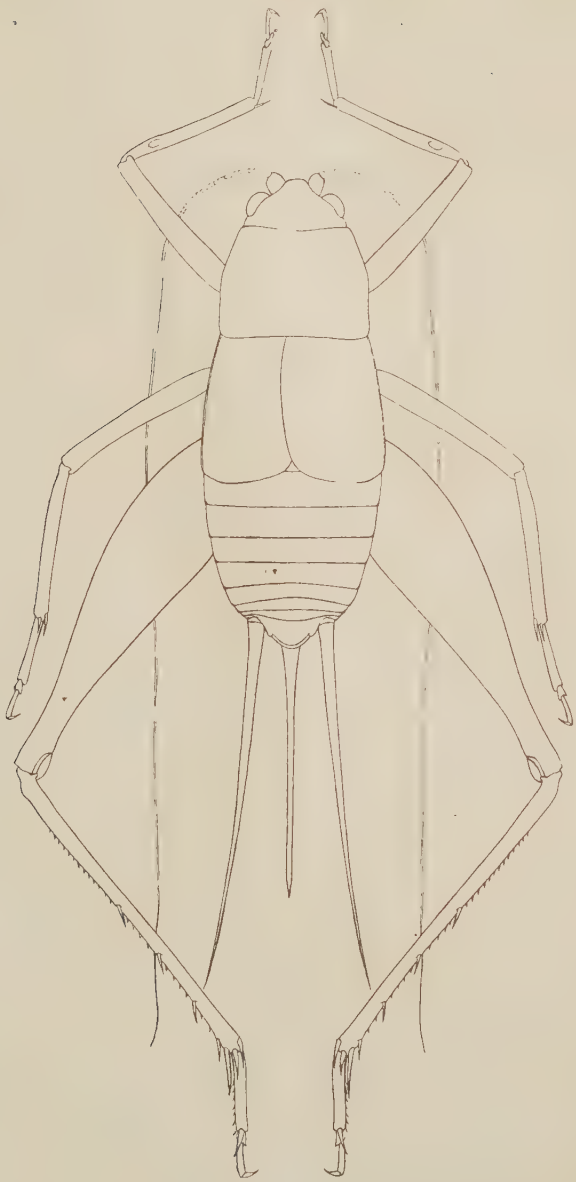
Fig. 1. *Luzara rufipennis* (Walker). Dorsal outline of male. Cinco Bocas, Sierra San Lorenzo, Colombia. (X 3)



HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

PLATE X

Fig. 1. *Luzara rufipennis* (Walker). Dorsal outline of female. Minca, Magdalena, Colombia. (X 3)



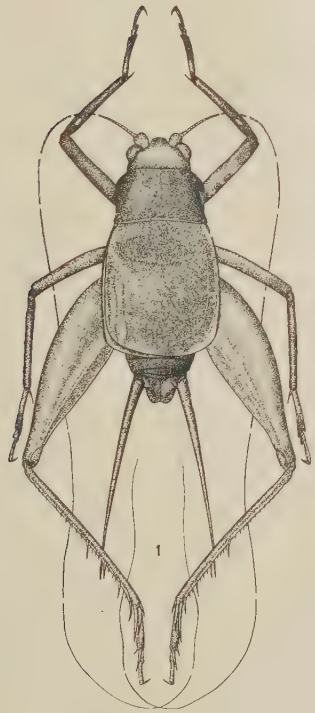
HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

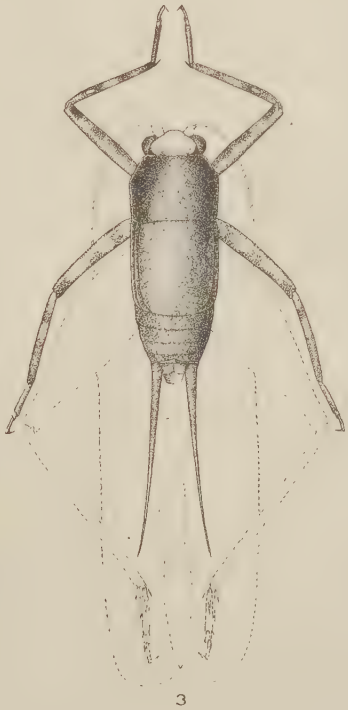
PLATE XI

Fig. 1. *Luzara minor* new species. Dorsal view of male. *Type.* Aracataca, Magdalena, Colombia. (X 3)

Fig. 2. *Luzara minor* new species. Lateral view of female. *Allotype.* Aracataca, Magdalena, Colombia. (X 3)

Fig. 3. *Amusodes albifrons* new species. Dorsal view of male. *Type.* Kartabo, Bartica District, British Guiana. (X 3)





HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

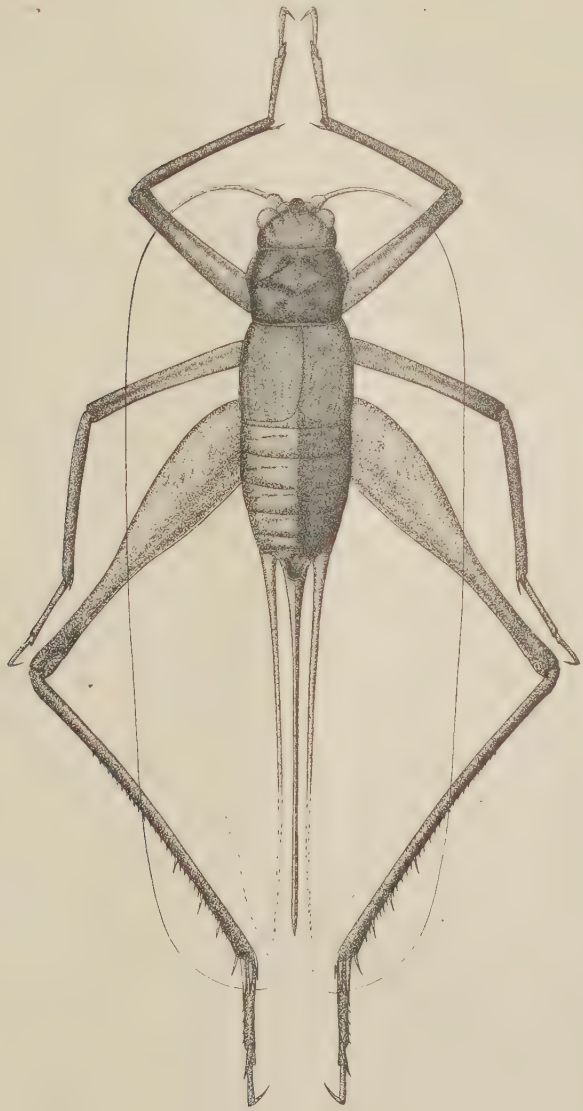
PLATE XII

Fig. 1. *Amusodes festae* (Giglio-Tos). Lateral view of female. Andagoya, Antioquia, Colombia. (X 3)

HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

PLATE XIII

Fig. 1. *Megalamusus casenare* new species. Dorsal view of female. ***Type.*** Palmar, Santander, Colombia. (X 2)



HEBARD—THE GROUP LUZARAE (ORTHOPTERA)

CONTRIBUTIONS TO OUR KNOWLEDGE OF NORTH AMERICAN HALTICINAE
I. NOTES, WITH DESCRIPTIONS OF NEW SPECIES
COLEOPTERA: CHRYSOMELIDAE

BY L. G. GENTNER

East Lansing, Michigan

This paper is being published with a view toward adding to what we know of North American flea beetles. It contains descriptions of five new species and notes on four others. The writer is indebted to the United States National Museum and The Academy of Natural Sciences of Philadelphia for the loan of certain material for study.

Along with other systematic workers with the flea beetle group, I have hoped that North American specimens could be named without a study of the male penis, as is done in Europe. However, it became necessary to make a study of this organ to substantiate certain conclusions, and that character has been found very valuable in settling some of the points which have long been in question.

Haltica aeneola Blatchley (*H. aenescens* Blatch.)

A series of about sixty specimens had been placed in my collection under the manuscript name of *H. similis*. The majority of these had been collected at East Lansing, Michigan, during 1923 and 1924, by sweeping marsh grass, mostly during May, while a few were taken in June, one in July and one in September. The others are from Wisconsin, Maine, New Hampshire and Massachusetts. It is strange that I have not been able to separate out a single male from this series, even though the genitalia were examined.

Professor W. S. Blatchley kindly compared two of these specimens for me with his type of *H. aeneola* (*aenescens*), which is a male, and wrote me as follows: "It is very close to my

species, the color being nearly the same. Your specimens are slightly larger, with sides less parallel, pronotum slightly wider, with basal transverse impression more distinct, umbones slightly more prominent. Your specimens are not marked as to sex, but neither of them has the impression of the last ventral as in my male of *aeneola*. Unless you have the male differentiated, yours may be the female of my species." Since the differences noted by Professor Blatchley are such as are likely to be found between males and females of a species, I am placing this series, for the time being, as *H. aeneola* Blatch.

My specimens are from 3.25 mm. to slightly more than 3.5 mm. in length. The color varies from brassy-greenish to brassy-bronze. The pronotum is more or less alutaceous. The ante-basal groove varies from very faint to quite distinct, but it is never deeply impressed and ends at either side in a distinct, deep fovea, which is somewhat crescent-shaped, and which nearly reaches the margin. The foveae are much more deeply impressed than in *H. tombacina* Mann. (*evicta Lec.*), and come nearer the margin than in that species. The antennae and tarsi show more or less reddish-brown at the apices of the segments.

From *H. rosae* Woods, aside from color, it may be readily distinguished by its relatively shorter, stouter, antennal joints, its somewhat less transverse pronotum with more arcuate sides, its shallower ante-basal groove, its somewhat more prominent depressions within the umbones, and its somewhat more parallel outline of the elytra. The elytral punctures are rather fine and widely separated, with some very fine punctures intermingling. The punctures of the pronotum are even finer, and more closely placed.

Haltica foliacea LeConte

Under this name systematic workers have been placing a complex of specimens which resemble each other in a general way, but which show considerable differences when a close examination is made. According to Horn's key they all run to *foliacea*, but it is my opinion that there are several distinct species now included under this name. One of these, a blackish-blue form from Arizona, Colorado and Nebraska, I have long felt loth to classify as *foliacea*, and in this paper it is being described as new.

Haltica brisleyi new species

Elongate ovally moderate, convex, moderately shining, finely alutaceous. Color a uniform violaceous blackish-blue.

Vertex smooth, finely, but distinctly alutaceous; frontal carina prominent, tubercles distinct, broadly sub-triangular, separated from each other by a short, broad, impressed line. Antennae about one-half the length of body, joints stout, widening, decidedly towards tip, 2, 3, 4 distinctly increasing in length, 4 twice as long as 2, 10 two-thirds as broad as long. Eyes not very large, their width as seen from in front, not quite one-third the interocular distance. Pronotum about one-half wider than long—a little narrower in males and wider in females, distinctly wider in front than head, sides subparallel on basal half, not much narrowed anteriorly, front angles thickened, rather prominent, disk not very convex on basal half, punctures extremely fine, but deeply impressed, moderately closely, very irregularly placed, a group of coarser punctures near each apical angle, ante-basal groove narrowly and not deeply impressed, not reaching margins, and ending in a large, shallow fovea on either side. Elytra scarcely wider at base than thorax, humeri rounded, umbones not prominent, sides regularly arcuate, tapering to apex, disk more or less distinctly alutaceous, surface uneven with indications of irregular, broken, longitudinal carinae and impressed lines, punctures slightly coarser than those of pronotum, very fine, well spaced, distinctly impressed, coarser along basal part of suture, finer toward apex. Abdomen beneath finely, moderately closely punctured, punctures bearing pale, yellowish-brown setae. Legs stout. Male with first joint of anterior tarsi strongly dilated, and last ventral segment with a rather broad, short, flattened median lobe having a reflex margin and broad impressed longitudinal line extending one-half to two-thirds the length of segment. Length 3.72 to 4.73 mm.; width 1.82 to 2.45 mm.

Type:—Male; Verde Valley, Arizona, May 11, 1926, from *Gaura pariflora* (H. R. Brisley). [In collection of Entomology Department, Michigan State College.] *Paratypes* in collections of United States National Museum, Canadian National Museum, California Academy of Sciences, H. R. Brisley, The Academy of Natural Sciences of Philadelphia, and others.

Described from a large series of specimens from Arizona, Colorado and Nebraska. This species stands in most collections as *H. foliacea* Lec. From *foliacea* it may be readily separated

aside from the dark color, by its much stouter legs and antennae, and its extremely fine, sparse punctuation which is barely visible under a hand lens. The pronotum is less convex and its sides do not narrow as much to the front. The first joint of the anterior tarsi of the male is very prominent, being nearly three-fourths as broad as long, while in *foliacea* it is only slightly more than one-half as broad as long. The last ventral segment of this sex has a broader apical lobe with more prominent impression. The most decided difference is in the shape of the male penis. These organs differ markedly from each other in the two species.. It should be placed near *foliacea*.

Male penis of *brisleyi*—relatively broad, one-third as wide as long; narrow at base, sides suddenly widening, giving appearance of shoulders, slightly incurved at middle, curving outward again and then broadly rounding to apex, presenting a broadly oval appearance of apex. Side view—basal fourth turned down, apical third slightly upward; width quite uniform on basal half tapering gradually to apex. Sculpture of under side—smooth, slightly concave on basal third, a deep, suboblong median excavation on apical third, bordered by a sharp ridge on either side; a feeble median ridge on middle third, divided into two closely placed branches on apical fourth, within the excavation; lateral margins on apical third ridged.

Male penis of *foliacea*—relatively narrow, slightly more than one-fifth as wide as long, subparallel, sides slightly incurved at middle and but slightly tapering to apex, apex bluntly rounded. Side view—sinuate, curved downward shortly at base, rather weakly at apex, and rather broadly, shallowly curved downward along middle third; width rather uniform on basal two-thirds, then narrower to apex. Sculpture of under side—a median ridge, not reaching base, and two submarginal ridges, which give the surface the appearance of two longitudinal grooves, deeper toward apex, submarginal ridges curved inward at middle, median ridge divided into two closely placed branches on apical fourth.

Mr. Brisley has kindly sent me a series of this species which he collected at Verde Valley, Arizona, in May, 1922, June, 1924 and May, 1926 from *Gaura parviflora* Dougl. He records the

habits of this insect in his paper on the Chrysomelidae of Arizona * under the erroneous name of *Haltica obliterata* Lec. Most Colorado specimens were collected at Denver in June and July, 1911 (C. A. Frost), two specimens (Morr.). Nebraska specimens were from Cambridge, July, 1922 (A. P. M.).

Several specimens have greenish reflections and two males were noted with impression of last ventral of male extending the entire length of segment.

Haltica nigra new species

Elongate oval, moderately convex, strongly shining, uniformly black in color with a faint purplish tinge and faint blueish-green reflections. Tarsi with an indication of brown.

Vertex impuctate, alutaceous, frontal carina distinct, acute, tubercles distinct, moderately large, with upper margins definitely limited by a transverse, impressed line. Antennae one-half the length of body, joints moderately short and stout, 2, 3, 4 increasing in length. Eyes not prominent, their width as viewed from the front about one-third the interocular distance. Pronotum one-third wider than long, sides regularly arcuate, widest at about middle, narrowed to apex and base, margin very narrow, apical angles not prominent, basal angles obtuse, punctures fine and sparse, especially at center, a group of coarse punctures near each apical angle, extremely faintly alutaceous, ante-basal groove almost obliterated with scarcely a trace visible except at sides. Elytra moderately convex, conjointly elongate oval, somewhat subparallel in outline, rather broadly rounded to apex, with a faint sinuation each side before apex, each elytron 3 times as long as wide, base very little wider than base of thorax, humeri indistinct, umbones not prominent, disk rather sparsely, deeply fairly coarsely punctured, quite fine toward apex, surface faintly alutaceous. Abdomen beneath finely alutaceous, moderately coarsely, moderately closely punctate. Last ventral of male with a very broadly-rounded prominent median lobe, with a deep, concave, almost circular impression covering a good part of segment, at center of which is a slightly deeper longitudinal impression. Length, 3.69 mm.; width 1.75 mm.

Type:—Male; Clouderoft, New Mexico, June 17, 1902, (H. L. Viereck). [In collection of The Academy of Natural Sciences of Philadelphia, No. 8133.]

*Trans. Amer. Ent. Soc., LI, p. 176, 1925.

Described from a single specimen. It is quite distinct from any known *Haltica* because of its elongate form, black, shiny appearance, scarcely evident ante-basal groove, and very prominent median lobe of last ventral of male, with large, deep impression. The lobe and impression are even more prominent proportionately than in my *H. canadensis*. The under side appears to have a greenish tinge. This species approaches my *H. elongata*, but the latter has more slender antennae, the ante-basal impression more prominent, more slender form, punctuation finer, elytra more convex and tapering behind middle to apex, surface uneven. It should be placed just before *elongata*.

Chaetocnema parvula new species

Elongate oval, moderately convex, black, shining; head and thorax finely and densely alutaceous, only moderately shining, subopaque; antennae and legs rufous, except posterior femora which are piceous.

Vertex impunctate except for a few coarse punctures near each eye. Pronotum three-fifths wider than long, subquadrate, scarcely narrowed anteriorly, front angles somewhat thickened, without post-apical angulations, hind angles slightly rounded to base, surface with a faint aeneous luster, distinctly, relatively densely and moderately coarsely punctate, the punctures well separated, somewhat unevenly spaced and becoming coarser toward base, basal marginal line fine but distinct. Elytra scarcely wider at base than prothorax, humeri not prominent, umbones faint, smooth, sides regularly arcuate, widest a little in front of middle, tapering moderately to apex, surface scarcely visibly alutaceous, strongly shining, punctures not coarser than those of pronotum, if as coarse, separated in the striae by at least their own diameters, striae well spaced, impressed only near suture and lateral margins, intervals flat, not visibly punctate. Abdomen beneath shining, finely sparsely punctate. Length, 1.24 mm.; width .68 mm.

Type:—Male; Nogales, Santa Cruz County, Arizona, July 17, 1906, (F. W. Nunenmacher). [In collection of United States National Museum.]

Described from a single specimen. It is smaller than any other species of *Chaetocnema* known to me and may be readily distinguished from all others by its small size, rather narrowly

oval form, quite densely punctate, alutaceous pronotum, which contrasts with the shiny elytra. The only species approaching it in size is *obesula* Lec., which has an impunctate pronotum and a more robust and broadly oval form, *obesula* being close to three-fifths as wide as long while *parvula* is only slightly over one-half as wide as long. The head of *parvula* has a faint reddish—or brownish-bronze luster, the pronotum a dull aeneous or slightly brassy luster, while the elytra are of a deep black color.

Chaetocnema bicolor new species

Broadly oval, robust, very convex, decidedly shining. Color, black; head and pronotum with aenous luster; elytra dark blue; antennae and legs yellowish-brown, posterior femora piceous.

Vertex smooth, shining, very indistinctly rugulose, a deeply impressed line running from base of each antenna upward around posterior margin of eye, with a distinct spur branching in front of eye and running upward and inward toward vertex. Antennae scarcely infuscate at tips, joints very little thickened to apex. Pronotum three-fifths broader than long, much narrower in front, sides feebly arcuate, nearly straight, frontal and basal margins broadly arcuate, front angles without post-apical angulation, surface very faintly alutaceous, finely, sparsely punctate, the punctures elongate, widely separated, and quite regularly spaced, basal marginal line indistinct at middle, defined at each side by a row of small, indistinct punctures. Elytra scarcely wider at base than thorax, humeri broadly rounded, umbones feeble, smooth, sides broadly rounded to apex, somewhat subparallel on middle third, surface scarcely visibly alutaceous, striae regular, feebly impressed on disk, punctures round, coarser than those of pronotum, separated by their own diameters, intervals wide with extremely fine, irregularly placed punctures. Abdomen beneath shining, with first segment punctate at middle, and with a row of widely separated, indistinct punctures near the posterior margin of each of the other segments. Length, 2.06 to 2.37 mm.; width 1.37 to 1.5 mm.

Type:—Male; Nogales, Santa Cruz County, Arizona, August 28, 1906, (F. W. Nunenmacher). [Type and paratypes in collection of United States National Museum.] *Paratypes* in author's collection and that of Entomology Department, Michigan State College.

Described from a series of eight specimens all taken at Nogales, St. Cruz Co., Arizona during August and September, 1906 (F. W. Nunenmacher). This distinct species may be readily separated from other species by its blue elytra, broadly oval, robust form, smooth, strongly shining appearance, impunctate head, and slender antennae which thicken very little toward apex. According to Horn's key it should be placed after *parcepunctata* Cr.

Chaetocnema magnipunctata new species

Broadly oval, not very convex for the genus, brassy-bronze with slight greenish tinge, shining. Basal four joints of antennae, tibiae and tarsi more or less rufotestaceous.

Vertex impunctate except for a few punctures near each eye, densely alutaceous, dull. Pronotum about three-fourths wider than long, somewhat narrowed to the front, sides regularly arcuate, front angles without post-apical angulation, surface faintly alutaceous with conspicuous large, round, deep punctures, well separated, and irregularly placed, the intervening surface with extremely fine punctures which are scarcely visible under high power, basal marginal line distinct, defined on either side by somewhat smaller, closely-placed punctures. Elytra a little wider at base than thorax, broadly oval, broadly rounded to apex; humeri obtuse, umbones distinct, smooth, punctures about as coarse as those of pronotum, well separated, regularly placed in striae, sutural striae noticeably impressed, others not so much so, intervals not narrow, scarcely alutaceous. Abdomen beneath shining, finely alutaceous, finely, very sparsely punctate. Length, 1.75 to 1.95 mm.; width .94 to 1.07 mm.

Type:—Female; Needles, California, 550 to 750 feet, August 3, 1919, (Rehn & Hebard). [In collection of The Academy of Natural Sciences of Philadelphia. No. 8134.]

Described from three females from Needles, California, one of which is in the collection of Dr. Chas. Schaeffer. This species has the most conspicuously punctured pronotum of any of the smaller *Chaetocnema*. According to Horn's key it would be placed near *crenulata* Cr., from which it differs in its less robust form, brassy-bronze coloration, more conspicuous, round pronotal punctures (punctures elongate in *crenulata*), and darker antennae.

Longitarsus erro Horn

The males of this species are somewhat less ovate than the females. Recently emerged individuals are considerably paler than those fully hardened. The punctuation of the pronotum, in a series of twelve specimens from Monterey, Massachusetts, July 14, 1919 (C. A. Frost), varies from very fine and sparse to fairly coarse and distinct. I have seen other specimens from Sherborn and Framingham, Massachusetts (Frost), Wayland, Massachusetts (P. J. Darlington), Monmouth, Maine (Frost), Edmonton, Alberta, Canada (F. S. Carr). Length, 1.63 to 2.20 mm.

Longitarsus suspectus Blatchley

The common name of verbena flea beetle would seem to be quite appropriate for this insect, since I have taken it on no other host than *Verbena hastata* Linn. and on *V. urticaefolia* Linn. In Michigan and Wisconsin, it is one of our most common species of the genus. In Wisconsin I have taken it from April 9 to September 21, and in Michigan from May 20 to November 5. The adults of this species are night feeders like those of the mint flea beetle (*L. menthaphagus* Gent.), and during the day they may be found hiding beneath dead leaves, matted grass, or other objects near the bases of *Verbena* plants. Badly riddled plants may be swept with a net during the day time with the capture of only an occasional adult, however, if these same plants are swept late in the afternoon or towards dusk, specimens may be captured in numbers.

A study of a series of about two hundred specimens shows that this species varies in size from 1.5 mm. to 2.1 mm. The males are not as readily separated from the females as in the case of allied species, since the first joint of the anterior tarsi of the male is only a little wider than that of the female and the last ventral segment of the abdomen does not possess the median impressed line usually found in males of other species of this genus. It does, however, have a distinct median lobe which is broadly subtruncate at the apex. The males are usually relatively smaller and shorter than the females, with the elytra more tapering behind. (The shape of the first joint

of the anterior tarsi of the male may serve as a good secondary character for comparing species of Longitarsus since there is considerable variation between species.)

The punctuation of the pronotum becomes more dense and distinct toward the base. In some individuals the pronotum is quite smooth and shiny, and scarcely visibly punctate on the anterior half, while in others the surface is quite distinctly alutaceous, even slightly wrinkled, and the punctures are quite distinct. The elytra are always more or less alutaceous and may vary from rather shiny to rather dull. The punctures are always distinctly coarser than those of the pronotum, and rather shallow, becoming finer toward apex. Specimens collected in certain fluids may be of a rather pale yellowish-brown color, while cyanide specimens may be quite dark in color. In the case of both sexes collected in certain fluids the abdomen may be so distended as to cause the pygidium to protrude from beneath the elytra. In some specimens the membranous wings do not seem to be fully developed.

This species may be readily distinguished from *L. testaceus* Melsh., by its broader, relatively shorter, more robust, convex form, much coarser punctuation of the elytra, and by the fact that joints 2, 3, 4 of the antennae increase in length. In *testaceus* joints 2, 3, 4 are subequal, and the body is longer, narrower and rather subdepressed, while the surface is usually quite dull and alutaceous.

In addition to Michigan and Wisconsin specimens, I have taken one on *Verbena* at New Carlisle, Indiana, and have seen three specimens from Trenton, Ontario, Canada.

Longitarsus testaceus Melsheimer

A study of series of this species from Wisconsin, Michigan and Illinois, shows a certain number of individuals present in which the humeri are rounded, the umbones indistinct, and the wings only partly developed—one-fourth, one-third, or one-half the normal area. The punctuation, coloration, antennal structure and shape of pronotum agree with similar characters of the fully winged specimens, therefore, I am placing these partly winged specimens as *testaceus*, even though that species was

described as being fully winged, with distinct umbones. The form of the penis of the males does not differ in the two forms. In some series there is a considerable percentage of the partly-winged form, a condition which occurs in the females as well as in the males. A careful study of large series of a number of species of *Longitarsus* leads me to believe that there is a gradual degeneration or reduction going on in the membranous wings.

The punctuation and degree of alutaceousness, especially of the pronotum, is quite variable in individuals, even among those collected on the same day, in the same locality, under similar conditions. Some may have the pronotum rather finely and sparsely punctate and only faintly alutaceous, while others may have it much more distinctly and densely punctate, and quite dull and densely alutaceous. In a few specimens the pronotum is quite dark, almost dark brown, with an infuscate suture. These agree in every other respect, even to the form of the male penis, with the typical specimens. Specimens preserved in certain collecting fluids are likely to be of quite a light yellowish-testaceous color, while those collected in cyanide are much darker and may become still darker and greasy with age. Unless this fact is kept in mind one may easily become confused in a systematic study because there is a wide range of color between specimens collected by different methods and also between freshly collected and old material, especially if the grease has not been removed from the specimens. Length, 1.60 to 2.25 mm.

THE CORNELL UNIVERSITY ENTOMOLOGICAL EXPEDITION TO SOUTH AMERICA, 1919-1920
SCIENTIFIC RESULTS, No. 4: PSELAPHIDAE
COLEOPTERA

BY FRANK C. FLETCHER

Cornell University

The Pselaphidae obtained by the expedition, though not numerous in species or individuals are however of great interest and value, inasmuch as eight of the species were collected in Peru, a region from which only four species of Pselaphidae have hitherto been recorded. Of the eleven species collected, seven are undescribed, and two cannot be identified beyond genus.

Arthmius (Arthmius) elegantulus new species

♂. Elongate, narrowed anteriorly; rufo-castaneous, legs paler; pubescence fine and scattered; impunctate, very shining.

Head subquadrate, sides behind antennal tubercles parallel; width including eyes about equal to that of prothorax; occipet and part of vertex concave, the latter with a pair of deep, punctiform foveae on the line of the posterior margin of the eyes; foveae closer to sides of head than to each other; front and anterior part of vertex (at middle line of the eyes) deeply excavated, the antennal tubercles very prominent, projecting beyond sides of head; posterior margin of excavation sharply limited; within provided with a large and sharp longitudinal carina extending posteriorly from the line of the anterior margin of the antennal tubercles to near the basal edge where it joins an erect, thin, transverse and bidentate lamella fimbriate on the sides; bottom of excavation on either side of carina deeply depressed; posterior wall clothed with pale pubescence; posterior angles of head densely clothed with long pubescence. Antennae slender, extending beyond base of elytra; first segment elongate, broader than any of the others except the last two, unmodified; second elongate, oval, shorter than any of the succeeding six; three to eight elongate of same form, subcylindrical; three, four, six, eight of same width, five and seven slightly broader, four

shorter than third, about two-thirds as long as fifth; six shorter than five or seven; seven a little less than twice longer than eight; nine oval, ten subglobular, eleven elongate oval, narrowed from basal fourth, equal in length to the two preceding together; the last three segments abruptly larger forming a well-defined club.

Prothorax equal in length and breadth, sides widest just in front of middle, almost straight to apex and base, near base parallel; surface very convex, with a deep punctiform fovea on either side close to edge, these connected by a deep, sharply defined transverse sulcus; no lateral sulci.

Elytra slightly broader than long, two-fifths broader than prothorax, humeral callus well-marked; surface very convex with deep entire sutural striae; each elytron at base with three deep, distinct foveae.

Abdomen slightly longer and narrower than elytra, evenly tapering to pointed apex; first dorsal somewhat longer than fourth; second and third short, equal in length, four large, longer than the two preceding together, fifth small, forming a pygidium, invisible from above; first ventral with a sharp, longitudinal carina, second long, three and four short, equal in length, five very deeply emarginate, containing the last, which is broadly concave and strongly lobed at apex.

Metasternum broadly concave, with a deep narrow sulcus in the depression, armed on either side behind the middle with a sharp spine.

Legs long, middle trochanters armed with a sharp spine; femora all swollen, middle ones more so; tibiae all slender and unmodified, the posterior slightly arcuate in apical half.

Length, 1.5 mm., width 0.6 mm.

Holotype:— ♂ ; June 18, 1920, Colony of the Perené, "El Campamiento", Peru. [Cornell University. Type No. 830.]

Elegantulus is a member of Group VI where it is most closely related to *cerastes* Raffray, from which the different sculpture of the head will at once distinguish it.

Arthmius (Arthmius) delicatus new species

♀. Elongate, narrowed anteriorly; rufo-testaceous, legs paler, translucent; very shining; pubescence sparse.

Head transverse, narrowed in front of eyes; width including eyes greater than that of prothorax; eyes large and prominent; front evenly declivous, epistoma convex; antennal tubercles convex, not extending beyond sides of head; vertex slightly convex, sides depressed anteriorly, forming a longitudinal,

median obtuse carina extending from the anterior margin of the tubercles posteriorly to the foveae where it disappears; foveae deep, punctiform, a little behind the middle line of the eyes; occipet with a very feeble depression; neck with a slender carina; antennae slender, extending slightly beyond base of prothorax; second segment ovate, broader than any except the last three; three to seven of about the same form, oval; five and seven broader and slightly longer than the adjacent, eight smaller subglobular; nine and ten globular, eleven as long as the two preceding, pointed at apex; nine to eleven enlarged, forming a distinct club.

Prothorax equal in length and width, widest slightly in front of middle, rapidly narrowed to apex, more gradually to base; posterior angles right; disc very convex, impunctate, shining; base with a deep transverse sulcus, ending on either side in a large fovea.

Elytra very transverse, convex, almost twice broader than prothorax; humeri none; base of each elytron with three distinct foveae; sutural stria deep and entire; sparsely covered with minute hair-bearing tubercles.

Abdomen longer than elytra, feebly rounded to apex; first dorsal a little longer than the remaining segments together; inner lateral carinae reaching apical third, oblique towards apex, outer sharp at base, but very feeble in the rest of their length; second and third equal in length, together equal to four; last very convex, somewhat rugose; first ventral longer than remaining together, carinate at base; next three equal in length along the median line; last simple. Metasternum slightly depressed along middle line. Legs unmodified.

Length, 1.5 mm., width 0.6 mm.

Holotype:— ♀ ; February 24, 1920, Parque Aconquija, Tucuman, Argentina. [Cornell University. Type No. 829.]

In antennal structure *delicatus* is related to the female of *bruchi* Raffray described from the Province of Buenos Aires, Argentina, but differs from it in the very transverse elytra, lack of carina at the base of the first ventral segment, and the sculpture of the head. In Raffray's table of species it would by the characters there given, be related to *planifrons* Schaufuss, but may at once be distinguished by the smooth antennal tubercles, the two foveae of the head, and the form of the antennal segments.

Arthmius (Arthmius) laevipennis new species

♀. Elongate; dark rufo-testaceous, legs paler; pubescence scattered, long, erect; impunctate, shining.

Head slightly transverse, width including eyes greater than that of prothorax; surface scarcely convex, with a fovea on either side on the line of the posterior margin of the eyes; the foveae prolonged anteriorly in an arcuate sulcus, completely and abruptly broken behind the antennal tubercles in the middle; vertex with a deep fovea, larger than the lateral ones, in the middle; front not depressed between the antennal tubercles; epistoma very convex; neck and base of occipet carinate; antennae long and slender reaching beyond base of elytra; second segment subquadrate, broader than any of the following six; third of same length, obconic; four to seven of same form, subcylindrical, four shorter, six narrower than five or seven, equal in length to these; eight shorter subovate, nine elongate, straight externally, somewhat rounded internally; ten of about the same form, broader, eleven elongate, as long as the two preceding together; the last three segments forming a distinct club.

Prothorax equal in length and breadth, widest in front of middle, rounded to apex, almost straight to near base, where the sides are parallel; surface very convex, with a deep fovea on either side connected by a strong transverse sulcus.

Elytra transverse, very convex; humeral callus wanting; base of each elytron with three distinct foveae; sutural striae deep and entire.

Abdomen one-fifth longer than elytra; first dorsal very large, longer than the remainder together; sides of first segment subparallel then rapidly narrowed to blunt apex; second and third segments short, equal, fourth longer, equal to the two preceding together, fifth convex, forming a convex pygidium, not visible from above; first ventral with a strong carina, undersurface otherwise unmodified. Metasternum concave apically, the cavity filled with dense pubescence. Legs slender, anterior femora more swollen than the others.

Length, 1.8 mm.; width, 0.8 mm.

Holotype:— ♀ ; July 28, 1920, Iquitos, Peru. [Cornell University. Type No. 828.]

The non-mucronate apex of the abdomen, carinate first ventral, slightly transverse head, and fovea of vertex, all indicate a close relation to *trifoveolatus* (Schaufuss), but the proportions of the antennal segments and sculpture of the head will serve to distinguish them.

Arthmius (Arthmius) magnus new species

♀. Elongate, slender; dark rufo-testaceous, legs a little paler; pubescence rather long, abundant, semi-erect; impunctate, shining.

Head transverse, sides parallel; width including eyes greater than that of prothorax; surface flat, vertex with a large transverse depression ending in front at the antennal tubercles and having within its posterior margin two deep punctiform foveae situated slightly behind middle line of the eyes; immediately behind each antennal tubercle a short arcuate sulcus; a few coarse punctures scattered over floor of impression, otherwise the head is not perceptibly punctate; antennae passing slightly the base of elytra; second segment cylindrical, a little longer than broad; three to seven subequal in width and of the same form, elongate very slightly narrowed at base; three, five, and seven subequal in length; four and six a little shorter; eight to nine more oval, gradually broader, ten subquadrate, narrowed at base, eleven elongate-oval, pointed at apex, a little longer than the two preceding together.

Prothorax cordate, equal in length and breadth, ventricose, with a very deep fovea on either side connected by a deep transverse sulcus.

Elytra transverse, very convex; humeral callus wanting; base of each elytron with three very deep foveae; sutural striae deep and entire.

Abdomen longer and broader than elytra; first dorsal slightly longer than the remaining together; two and three short, equal, four slightly shorter than the two preceding together, fifth forming a pygidium hardly visible from above with a blunt protuberance at tip; base of abdomen beneath with a strong carina; apex of last ventral transversely strigose. Metasternum broadly sulcate. Legs unmodified, all femora clavate.

Length, 2.6 mm.; width 1 mm.

Holotype:— ♀; July 28, 1920, Iquitos, Peru. [Cornell University. Type No. 833.]

Because of its simple tibiae and tuberculate apical abdominal segment, *magnus* is related to the three species described by Raffray, *articularis*, *productus* and *peruvianus*. From the first it is at once distinguished by the pygidium being simply tuberculate and not at all pointed and the lack of a median fovea on the head; from the other two by the differently sculptured head.

Oxarthrius simplex Raffray

One female of what I consider to be this species was taken by the Expedition June 21, 1920, at the Colony of the Perené "El Campamiento", Peru, at an altitude of 2,000 ft. *Simplex* was described from one female specimen coming from "Haut Bolivie: tribu du Yuracaris" and has not been recorded since. The specimen before me agrees in almost every respect with Raffray's description, the only discrepancies being that the seventh antennal segment though longer than the eighth, is equal to the sixth and not longer as the description indicates, and the pubescence though fine is not what I would consider very short.

Reichenbachia femoralis new species

♂. Elongate, rather slender; dark testaceous, legs and antennae slightly paler; pubescence short, scattered, recumbent; subimpunctate, shining.

Head very elongate, narrowed anteriorly, width including eyes less than that of prothorax; surface feebly convex, with two pubescent foveae on the vertex behind the middle line of the eyes, closer to the eyes than to each other; front between the antennal tubercles depressed, with a very small third fovea; scarcely evidently punctulate, a few more evident punctures on antennal tubercles; antennae long and slender, three apical segments passing base of elytra; first segment very elongate, cylindrical; second cylindrical, longer than broad, shorter; three to seven much longer than broad, narrower, subequal in width, three slightly narrowed at base, others subcylindrical, three and four equal in length, twice longer than broad; five a little longer than either four or six, six to eight increasingly shorter, eight subquadrate; nine to ten gradually broader, subcylindric, very slightly longer than broad; eleven elongate oval, as long as the two preceding together.

Prothorax very slightly broader than long, widest just in front of middle; surface convex, very finely punctulate; a nude fovea at middle and a larger pubescent one on either side.

Elytra slightly transverse, broadest behind the middle; disc convex, with strong entire sutural striae, the discal subparallel and not reaching middle; base of each elytron with two foveae.

Abdomen longer than elytra; sides of first segment parallel, the abdomen then gradually tapering to apex; base of first dorsal with two slightly divergent carinae, not reaching middle and enclosing at base one-half of the total width of the segment; ventral segments slightly flattened along the middle line. Metasternum flattened.

Legs slender; middle tibiae armed with a strong spine internally near tip; posterior femora very strongly dilated, the dilation broadly and entirely excavated on its posterior face.

Length 1.8 mm., width 0.8 mm.

Holotype:— ♂; July 12-19, 1920, Puerto Bermudez, Rio Pichis, Peru. [Cornell University. Type No. 827.]

This species does not fit in any of the groups proposed by Raffray, though it belongs in his Division V, containing groups XXIX to XXXII. It differs from the members of these groups in having all the tibiae simple (the middle however armed below apex with a strong spur), anterior and middle femora simple, the posterior however being greatly dilated as described above.

Reichenbachia limpida new species

♂. Elongate-oval, quite convex; dark testaceous, elytra rufous; very finely and minutely punctulate, shining; pubescence pale, dense, very short and stiff, suberect.

Head from epistomal margin longer than wide, narrowed anteriorly; width including eyes slightly less than that of prothorax; eyes very large and prominent; surface slightly convex, with a very large and deep pubescent fovea on either side a little behind the middle line, and very close to the eyes; a third pubescent fovea of the same size between the bases of the antennae; antennal tubercles and notably raised above the general surface of the head; scarcely perceptibly punctulate, shining; antennae slender, reaching beyond base of elytra; first and second segments larger than the following; second cylindrical, slightly longer than broad; three to seven about equal in width, three and five subequal in length, subcylindrical, slightly narrowed at base, third the more so, four, six, and seven shorter, decreasing in length, subcylindric; eight to eleven gradually broader, eight a little transverse, nine transverse, ten narrowed at base, just visibly longer than broad; eleven as long as the three preceding together, obliquely and acutely pointed at apex.

Prothorax transverse, broadly rounded in front of middle, almost straight to apex, and to base where it is slightly sinuate at basal angles; upper surface very convex, with a large pubescent fovea on either side and a smaller nude one nearer base at middle.

Elytra subquadrate, widest in apical third, surface very convex; base of each elytron with three distinct foveae, the inner giving rise to a deep entire sutural stria, the outer to a very

feeble discal stria which does not quite reach the middle; punctuation dense but very fine.

Abdomen almost equal in length to elytra; first dorsal about as long as the remaining together, provided at base with a pair of subparallel carinae reaching apical third and including at base almost one-third of the entire width of the segment; undersurface convex, last ventral lobed and broadly impressed. Metasternum slightly flattened.

Legs of usual length; anterior and posterior femora swollen, of the same size, middle somewhat larger; middle trochanters armed with a sharp spine on the middle of the posterior margin; middle tibiae with a brush of pale hairs at apex within; poster tibiae strongly arcuate, likewise with brush of hairs.

Length, 1.8 mm., width 0.9 mm.

Holotype:— ♂ ; August 12, 1920, San Antonio del Rio Cotuhé, Peru. [Cornell University. Type No. 831.]

This species should be placed near Raffray's group VI, a group including no species from the New World. The long carinae of the first dorsal abdominal segment and the spined trochanters will readily serve to distinguish *limpida* from the members of this and other groups.

Decarthron lamellipes new species

♂. Elongate-oval; light rufotestaceous; subimpunctate (except elytra), shining; pubescence, especially on the abdomen, long, suberect.

Head subquadrate, width including eyes equal to that of prothorax; vertex and occipet feebly convex, the latter lightly impressed; front depressed between the antennal tubercles, which are prominent; post-antennal sulci broad and pale yellow in color; vertex with a pair of large, deep foveae, more distant from one another than from the eyes; these connected by a hardly perceptible sulcus; eyes large, convex, and prominent; antennae passing base of prothorax, by a length equal to that of the last segment, rather slender; second segment cylindrical; three elongate, obconic longer than either two or four; four to six subequal in length, longer than broad, five very slightly narrower than adjacent; seven slightly broader, subquadrate, eight to nine gradually larger, both slightly transverse; ten oblong, almost as long as the three preceding together.

Prothorax equal in length and breadth, sides widest at middle, then almost straight to apex and base; surface very convex, with a deep fovea at middle of base.

Elytra about twice broader than prothorax, widest in apical third; each elytron with a deep, entire sutural stria, and a well-marked discal stria reaching apical one-fifth, the two discal striae parallel; base of each elytron bifoveate; area between each discal and sutural stria with a few very coarse and deep punctures.

Abdomen one-fifth shorter than elytra, sides of first segment subparallel, then rapidly narrowed to blunt apex; first dorsal slightly shorter than remaining together, with a pair of parallel carinae at base, including at base exactly one-half of the entire width of segment, and extending one-half of its length; undersurface evenly convex, last ventral lobed at apex. Metasternum broadly concave, with a few sparse scale-like hairs.

Legs of usual length; all the femora unmodified, the posterior more slender than the others; anterior tibiae slender, straight, middle straight provided at apex within with a thin longitudinal lamina not quite one-third as long as the total length of the tibia and almost as wide as the tibia itself; posterior tibiae flattened and arcuate when viewed from the outer side.

Length, 1.4 mm., width 0.8 mm.

Holotype:— ♂ ; July 12-19, 1920, Puerto Bermudez, Rio Pichis, Peru. [Cornell University. Type No. 832.]

This species is remarkable in its simple middle femora and the lamina of the middle tibia. In Raffray's groupings it would fall in group XI near *fallaciousum* Sharp, with which however it has no particular affinity. *Lamellipes* occupies a unique position in the genus and with its simple middle femora and peculiar middle tibiae should be at once recognized.

Decarthron sp.

One female specimen of this genus was collected between the fourteenth and twenty-second of December 1919 at Corumba, Matto Grosso, Brazil. In the present state of our knowledge of this genus, it is quite impossible to identify most females unless taken with males.

Hamotus (Hamotoides) sp.

A single male specimen, possibly *bellus* (Schauf.), but lacking both antennae and therefore unidentifiable was collected while sweeping grass and field grains July 16, 1920, at Puerto Bermudez, Rio Pichis, Peru. No member of this subgenus has heretofore been recorded from Peru.

Pseudohamotus inflatipalpus (Reitter)

One specimen, Nictheroy, Rio de Janeiro, Brazil, collected October 15, 1919. Described from Blumenau.

STUDIES IN THE DERMAPTERA AND ORTHOPTERA OF COLOMBIA.

FIFTH PAPER

Orthopterous Family Gryllidae

BY MORGAN HEBARD

Comparing the number of species about to be recorded from Panama with those we have studied from Colombia, we find that the latter collections include slightly less than half as many species of Gryllidae. This is largely because the family is so very poorly represented in the collections from central Colombia and the Andean localities. This, the final study preliminary to our treatment of the Dermaptera and Orthoptera of the region about Santa Marta, is consequently even more incomplete than those which preceded it [1], excepting the Dermaptera.

Little consequently remains to be added to our comments in the introduction to the Acrididae in the third paper of the series. The close relation of the fauna of the Chocó to that of Central America has, however, become more evident, the very great majority of the Colombian species which show North American affinity coming from that region.

In the present paper a series of two hundred and nineteen specimens are recorded[2], representing twenty-nine genera and forty-four species, of which five genera and thirteen species are new. The material treated in the present paper belongs to the author and is deposited at the Academy of Natural Sciences of

[1] On the Dermaptera, Blattidae, Mantidae and Phasmidae, Trans. Amer. Ent. Soc., XLV, pp. 89 to 179, (1919); on the same, Trans. Amer. Ent. Soc. XLVII, pp. 107 to 169, (1921); on the Acrididae, Trans. Amer. Ent. Soc., XLIX, pp. 165 to 313, (1923), and on the Tettigoniidae, Trans. Amer. Ent. Soc., LII, pp. 275 to 354, (1927).

[2] Forty additional individuals belonging to the Group Luzarae from Colombia have been discussed in our recent revision of that Group and are consequently merely referred to in the present paper. These were found to include representatives of five new genera and seven new species.

Philadelphia, unless otherwise noted. Ridgway's "Color Standards and Nomenclature" has been used to indicate the exact coloration, as is our custom. We are deeply indebted to Hermano Apolinar Maria of the Instituto de la Sallé, Bogotá, and Mr. M. A. Carriker, Jr., of Hacienda Vista Nieve, Santa Marta, through whose field cooperation we have been enabled to undertake these studies.

The following table is compiled from our five papers on the Dermaptera and Orthoptera of Colombia, in which three hundred and forty species have been discussed.

Affinity or origin	Dermaptera	Blattidae	Mantidae	Phasmidae	Acrididae	Tettigoniidae	Gryllidae
Colombian exclusively	4	23	5	27	43	30	18
South American	2	19	7	3	25	27	6
North American	0	9	4	0	14	13	7
North and South American	2	9	4	1	16	10	12
Total	8	60	20	31	98	80	43

The one hundred and fifty species, listed as exclusively Colombian, will probably be reduced in number as the adjacent faunas become better understood, but this will hardly be considerable, as multitudes of species peculiar to Colombia are undoubtedly still unknown. The fifty-four species already known also from North and South America will probably show little increase, the majority of these being widespread forms, among the first to be secured wherever found. A very large percentage of the Colombian species occurring elsewhere only in North America, eighty-nine in number, come from the Chocó in northwestern Colombia. The almost double quantity of forms of South American origin is to be expected when we realize that, except for the northwestern portion, the many diversified areas of Colombia have been, with few exceptions, populated by invasions from the east or south. Of the species from altitudes over 8000 feet, all are exclusively Colombian.

The very rich fauna of the humid tropical lowlands normally extends several thousand feet up the mountain sides, there show-

ing considerable attenuation, but in some regions even reaches much higher. On the mountain slopes there are many forms peculiar to the zones there found, but these are never as multitudinous as in the lowlands. Much more concentrated collecting with exact data given will, however, be necessary before satisfactory knowledge of these zones and the number of species inhabiting each can be obtained from an Orthopterological standpoint.

The semi-arid tracts, particularly along the north coast of Colombia were more extensively examined by Rehn and Hebard in 1920, during the few days that such was possible, but no index of its being a faunal center was found; of eight species largely or wholly confined to that very distinctive appearing region two grasshoppers are peculiar to it though plainly nearest forms inhabiting the arid western coast of South America, one grasshopper is close to North American species of the same genus, one katydid belongs to a northern Venezuelan and West Indian Group, while the others have all both North and South American affinities.

An unusually high percentage of the species found in the northern foothills of the Sierra Nevada de Santa Marta are peculiar to that region and a realization of this factor led Rehn and Hebard in 1920 to undertake intensive collecting there. The present paper brings to a conclusion the work needed to bring our knowledge of Colombian Orthoptera to a point where the more exhaustive study of the Santa Marta Region can be undertaken. That task we hope to begin in the near future.

Gryllinae

Gryllus assimilis (Fabricius)

1775. *Acheta assimilis* Fabricius, Syst. Ent., p. 280. [Jamaica.]

Palmar, Rio Casenare, Santander, April, 1917, (M. A. Carriker, Jr.), 1 ♂, 7 ♀, (1 ♂, 3 ♀ CZeu2; 4 ♀ AU or Z, b or d, u2 [3]).

Choachi, Cundinamarca, August, 1916, (from A. Maria), 1 ♂, 4 ♀, (A or B, X, b or d, u or v, 2).

Cordoba, Valle, May 23, 1918, (M. A. Carriker, Jr.), 1 ♀, (F (reddish) Zd (reddish) ul).

[3] Symbols discussed by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1915, p. 299.

Though found from southern Canada to Patagonia, this species is less abundant and probably less generally distributed in the tropics than in the temperate portions of its distribution.

Miogryllus verticalis (Serville)

1839. *Gryllus verticalis* Serville, Hist. Nat. Ins., Orth., p. 343. [♀, Cayenne.]

Santa Marta, Magdalena, October, 1917, (M. A. Carriker, Jr.), 1 ♀, (minute, lateral, vestigial tegmina).

Mamatoco, Magdalena, December, 1917, (M. A. Carriker, Jr.), 1 ♂, (megacephalic, tegmina decidedly reduced, wings concealed).

Puerto Colombia, Atlantico, July 11 and 12, 1920, (Rehn and Hebard), 1 juv. ♀.

Not only do these large specimens show extreme tegminal reduction (exposed length ♂ 5.7, ♀ 1.7), but the male is even more decidedly megacephalic than those recorded by us from Venvidio, Sinaloa, Mexico, the convexly protruding cheeks causing the head to be distinctly broader than deep.

This adult pair is very dark, the head showing no trace of pale post-ocular or occipital lines which in specimens of recessive coloration are usually present and conspicuous.

The species is known from Lakehurst, New Jersey, to Mendoza, Argentina, and though rarely common is apparently more generally distributed and numerous in the temperate portions of its distribution than in the tropics.

Anurogryllus muticus (DeGeer)

1773. *Gryllus muticus* DeGeer, Mém. Hist. Nat. Ins., III, p. 520, pl. 43, fig. 2. [♂, ♀; Surinam.]

Santa Marta, Magdalena, October, 1917, (M. A. Carriker, Jr.), 1 ♀, (wings concealed).

Mamatoco, Magdalena, December, 1917, (M. A. Carriker, Jr.), 1 ♀, (wings caudate).

Unlike the preceding species, this insect is more numerous and more often encountered in the tropics than in the temperate portions of its range. It is known from Ocean View, New Jersey, to Bahia Blanca, Argentina.

Gryllomorphinae

Odontogryllus setosus Saussure

1877. *O[dontogryllus] setosus* Saussure, Mém. Soc. Phys. d'Hist. Nat.
1898. *O[dontogryllus] niger* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XIII, p. 104. [♀; Valley of Santiago, Ecuador.]

From comparison of the above descriptions with Colombian material we believe that *setosus* was described from a small immature male, *niger* from an adult female of the same species. Though adult material from the Andes south of Colombia may show the presence of more than one species, it appears more probable that Giglio-Tos' *niger* is a synonym and that our Colombian material is specifically indistinguishable.

The smallest immature males before us agree closely with Saussure's original description except that the apices of rounded

ERRATUM VOL. 54, Page 83

Odontogryllus setosus Saussure

1877. *O[dontogryllus] setosus* Saussure, Mém. Soc. Phys. d'Hist. Nat. Genève, XXV, p. 279, pl. 14; XXV, figs. 6, 6i and 6e. [[Juv.] ♂, Peru.]
1898. *O[dontogryllus] niger* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XIII, p. 104. [♀; Valley of Santiago, Ecuador.]

the females are apterous. The cephalic tibiae lack auditory foramina and are more slender than in *G. assimilis*. The general form of the head is much as in that species, but the fastigium, though very broad, is not as wide and the triangle formed by the ocelli is less strongly transverse. The palpi and caudal metatarsi are decidedly shorter, the latter with two rows of more numerous and heavier dorsal spines. The male subgenital plate is more produced; scoop-shaped, with apex truncate. The ovipositor is heavier and straight. The caudal femora are as in *G. assimilis* and it is not until we reach the caudal tibiae that the Gryllomorphine association is found. They are armed dorsad with four pairs of opposed spines, those of the external margin preceded by a number of small but sturdy teeth; the

medio-internal spur is the longest, half as long as the metatarsus and slightly longer than the medio-external, which is in turn longer than the ventro-internal in about equal degree, the ventro-external about half as long as the medio-internal and slightly longer than the dorso-external, with dorso-internal about intermediate between these.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July 10, 1913, (M. A. Carriker, Jr.), 5 ♂, 8 ♀, 2 juv. ♂, 4 juv. ♀.

La Palmeta, Santander, 7500 feet, July 15 to 20, 1916, (M. A. Carriker, Jr.), 3 ♀.

Material collected subsequently by Rehn and Hebard on San Lorenzo and to be discussed in a study of the Orthoptera of that region, shows the altitudinal range of *setosus* to be there from 4100 to 5100 feet.

Nemobiinae

Hemigryllus ortonii (Scudder)

1869. *Nemobius ortonii* Scudder, Proc. Boston Soc. Nat. Hist., XII, p. 330. [♀; Napo or Maranon Rivers.]

Chocó, 1 ♂, 1 ♀, [Muz. Comp. Zool.].

This locality represents the northwestern limit for the species, known east to Independencia, Parahyba, Brazil, and south to Santa Rosa, Salta, Argentina.

It has been more frequently recorded as the synonymous *kriechbaumeri* [4].

Phalangopsinae

Gryllosoma choco Hebard

1927. *Gryllosoma choco* Hebard, Trans. Amer. Ent. Soc., LIV, p. 26, pl. 3, fig. 3. [♀, juv.; Andagoya, Antioquia, Colombia.]

As we originally observed, this insect, found in the Chocó of northwestern Colombia, is very closely related to the Panamanian *G. esau* Hebard and may prove to be a geographic race of that species.

Tairona pulchella Hebard

1927. *Tairona pulchella* Hebard, Trans. Amer. Ent. Soc., LIV, p. 27, pl. 4, figs. 3 and 4; pl. 5, fig. 4; pl. 6, fig. 3. [♂, ♀: Minca, Hacienda Cincinnati, and trail to Hacienda Vista Nieve, all on Sierra San Lorenzo, Magdalena, Colombia.]

[4] See Rehn, Trans. Amer. Ent. Soc., XLIII, p. 128, (1917).

This is a distinctive and unusually handsome little species, apparently peculiar to the Santa Marta region and there found among dead leaves under the mountain forest at from 2500 to 5000 feet.

Luzarida annuliger Hebard

1927. *Luzarida annuliger* Hebard, Trans. Amer. Ent. Soc., LIV, p. 39, pl. 7, fig. 4; pl. 8, figs. 2 and 3. [♂, ♀, juv.; Aracataca, Magdalena, Colombia.]

This handsome species was found in the same area of lowland lofty forest of the Santa Marta region as *Luzara rufipennis* Walker. Its color is decidedly less somber and more varied.

Luzarida pulla Hebard

1927. *Luzarida pulla* Hebard, Trans. Amer. Ent. Soc., LIV, p. 41, pl. 8, fig. 1. [♂; Muzo, Boyacá, Colombia.]

Closely related to *L. annuliger* Hebard, this is a darker species found on the eastern slopes of the Andes in Orinocan drainage.

Luzara rufipennis Walker

1869. *Luzara rufipennis* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 103. [♂, Colombia.]

We have recorded material belonging to the present collections from La Chorrera, Panama, and Minca, Aracataca and Loma Larga, all in Magdalena, Colombia.

This is a large somber cricket which lives in the dead leaves on the floor of the heavier forests from sea level up to 2500 feet in the Santa Marta region.

Luzara minor Hebard

1927. *Luzara minor* Hebard, Trans. Amer. Ent. Soc., LIV, p. 46, pl. 11, figs. 1 and 2. [♂, ♀; Santa Marta and Aracataca, both in Magdalena, Colombia.]

This insect, very closely related to *L. rufipennis* Walker, is distinguished by its smaller size, normally fewer veins in the lateral fields of the tegmina and shorter male tegmina.

We have already observed that the insect can not be a race of *rufipennis*, but may possibly be only an adaptation to some special environmental condition.

Amusodes festae (Giglio-Tos)

1897. *A[musus] festae* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 301, p. 6. [♀; Punta di Sabana, Darien, Panama.]

We have recently recorded this long-limbed species from Andagoya, in the Colombian Chocó and from several localities in Panama, at that time designating it genotype of *Amusodes*.

Megalamusus casenare Hebard

1927. *Megalamusus casenare* Hebard, Trans. Amer. Ent. Soc., LIV, p. 53, pl. 13, fig. 1. [♀; Palmar, Rio Casenare, Santander, Colombia.]

This very large cricket, with elongate limbs, rostrate fastigium, very strongly alternating caudal tibial spines and moderately approximate lateral ocelli belongs to the Group Luzarae but shows strongest divergence toward the Group Heterogrylli. It is known from the unique type.

Anacusta micans Hebard

1927. *Anacusta micans* Hebard, Trans. Amer. Ent. Soc., LIV, p. 54, pl. 6, fig. 8. [♀, juv.; La Pica, Santander, Colombia.]

This apterous, strikingly tessellate female and immature example were secured at 9000 feet on the eastern slopes of the Andes.

The strongly divergent lateral lobes of the pronotum strongly suggest *Amphiacusta* and its allies, but the widely spaced lateral ocelli, very weakly protruding fastigio-facial projection, short palpi and limbs and armament of the latter are all characteristic of the Group Luzarae. The species has no close relatives.

GROUP HETEROGRYLLI

EUGRYLLINA new genus

This genus is erected to include two very small species, one of which was found in the Santa Marta region of Colombia, the other in Panama and Costa Rica. Another species of similar appearance, from British Guiana, is found to represent a closely related genus with male tegmina distinctive and possessing a comparatively well developed, equal pair of ventral caudal tibial spurs.

Genotype: *Eugryllina acanthoptera* new species.

Size very small, body moderately elongate but plump, limbs rather short for the Group. Antennae extremely elongate. Fastigium rostrate, weakly declivent, relatively broad, nearly as broad as the very large proximal antennal joint, rounding suddenly into the vertical face. Ocelli very small, the lateral considerably closer to each other than to the median, which is apical in position, bounded ventrad by a distinct depression. Eyes very prominent. Palpi short or very short, the ultimate joint expanding evenly with truncate apex transverse or nearly so. Pronotum showing traces of medio-longitudinal sulcation and meso-lateral transverse impression; ventro-cephalic angle of lateral lobes rather sharply rounded and subrectangulate. Male[5] tegmina greatly reduced, corneous; dorsal field with venation almost wholly obliterated except along or near margins, but with stridulating vein faintly indicated; lateral fields without venation. Female without tegmina. Wings absent in both sexes. Male ultimate tergite simple, broadly truncate; subgenital plate unspecialized. Ovipositor shorter than caudal femur, moderately recurved, with apex vertically considerably expanded and so much deeper than wide. Cephalic tibiae lacking auditory foramina (in *veraguae*), or with a small circular one on cephalic faces[6]. Caudal femora robust, with slender apical portion very brief. Caudal tibiae with fine teeth, the proximo-internal of the usual four pairs of almost directly opposed spines absent, as well as the ventro-internal spur, leaving five instead of the usual six distal spurs[7]; external spurs small with median about twice as long as the others, dorso-internal spur three-fifths length of medio-internal spur in *acanthoptera*, nearly double length of medio-external and longer than medio-internal in *veraguae*. Caudal metatarsus with only a few teeth on dorsal margins.

[5] This sex is known only for the genotype.

[6] Present on one and absent on the other cephalic femur in one female before us of *E. acanthoptera*. This is a rare condition. In all of the twenty-five species of the Group Luzarae of which we have examined material no individual variation in the auditory foramina is shown except in three species, belonging to *Luzara* and *Luzarida*, while from Saussure's description of *Amusus kirschianus* (= *Luzara rufipennis*), material if correctly determined, shows similar variation.

[7] This character has neither Group or higher value, though such might be easily assumed. In the related genus *Aclodes*, the ventro-internal spur is usually absent, rarely present but extremely small in material of the same species.

Eugryllina acanthoptera new species (Pl. XIV, fig. 1; pl. XVII, figs. 1 and 2.)

The outstanding feature in this diminutive species is the reduced but distinctively specialized male tegmina (see pl. XIV, fig. 1), no parallelism being known in any other species of the Phalangopsinae.

The apterous female is readily separated from that sex of *A. veraguae* here described by the much shorter dorso-internal spur of the caudal tibiae and the shorter palpi. Unfortunately the male of that species is not known.

Type: ♂; trail from Hacienda Cincinnati to Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, Colombia, July 21, 1920. (J. A. G. Rehn.) [A. N. S. P., Type No. 5450.]

Size small, form moderately attenuate, limbs comparatively slender but of moderate length for the Group Heterogrylli. Lateral ocelli separated a distance from each other equalling about two-thirds that from one of them to the median ocellus. Fastigium not narrowing to where it rounds suddenly into face, its apex consequently broad. Palpi very short for the Group; last joint with apex weakly oblique truncate and about half the length of the straight ventral margin, that margin being slightly longer than the faintly concave dorsal margin. Tegmina covering less than half dorsal surface of abdomen, symmetrical in complete dorsal outline, corneous and glabrous; dorsal field oval with stridulating and lateral bounding veins distinct, the surface distad medio-longitudinally concave between rounded carinae which converge to form a stout straight apical spine; lateral fields narrow, without trace of venation. Titillators chitinous distad, without projections, the internal surface of the chitinous portion minutely granulose. Subgenital plate bluntly conical, flattened medio-longitudinally distad with hardly a trace of sulcation, its short transverse apical margin straight and unspecialized. Limbs and their armament as given in generic diagnosis, teeth of caudal metatarsus very fine.

Allotype: ♀; Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. July 22, 1920. (J. A. G. Rehn.) [A. N. S. P.]

Size, form and coloration very similar to male. Lateral ocelli similarly placed. Palpi very slightly longer. Ovipositor as given in generic description. Subgenital plate small, flattened, its free margin convex and showing scarcely any distal truncation.

General coloration mummy brown usually with a tawny tinge. Face buffy with vertical subocular suffusions of mummy brown and a broad vertical median band of the same which becomes deeper dorsad in the interantennal portion but is there cleft by a narrow vertical median line of buffy. Body and tegmina vaguely mottled buckthorn brown and mummy brown, two meso-distal abdominal tergites much paler and almost buffy in two specimens, another specimen showing lateral flecks of the same there. Limbs as described for *veraguae*.

Three male paratypes agree closely with the allotype in measurements. Length of body ♂ 9.8, ♀ 9.7; length of pronotum ♂ 1.9, ♀ 1.8; length of tegmen (dorsal, median) ♂ 3.9, ♀ absent; length of caudal femur ♂ 7.8, ♀ 7.4; width of caudal femur ♂ 1.9, ♀ 1.9; length of ovipositor 5.9 mm. (this dimension in paratypes 5.8, 5.9 and 6.2 mm.).

In comparing *acanthoptera* with *veraguae* it is interesting to note the unusual values of the characters which they exhibit. The agreement in armament of the caudal tibiae is extremely close until we reach the dorso-internal spur, which in *acanthoptera* is much shorter than the medio-internal but in *veraguae* is longer than that spur. These features in two very closely related species are remarkable in that the first condition is much as in the normal for the Group Luzarae, the second condition normal for the Group Heterogrylli. Again presence or absence of auditory foramina on the cephalic tibiae often constitute characters of generic value in the Phalangopsinae, but these organs are present on the cephalic faces of the cephalic tibiae in *acanthoptera*, absent in *veraguae*.

Specimens Examined: 5; 1 male and 4 females.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia, 4500 to 5000 feet, July 18 and 22, 1920, (J. A. G. Rehn; in mountain forest), 4 ♀, *allotype, paratypes*, [A. N. S. P.].

Trail from Hacienda Cincinnati to Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, Colombia, 4500 to 4800 feet, July 21, 1920, (Rehn and Hebard; in dead Guaumo leaves hanging in undergrowth of mountain forest), 1 ♂, 1 ♀, *type* and *paratype*, [A. N. S. P. and Hebard Cln.].

Upper timber of Sierra San Lorenzo, Magdalena, Colombia, 7500 to 7900 feet, July 29, 1920, (M. Hebard; in low thick upper mountain forest), 1 ♀, *paratype*.

Eugryllina veraguae new species (Pl. XVII, fig. 3.)

Unfortunately we have only females of this species, which is, however, readily separated from that sex of *E. acanthoptera*

here described by the more elongate palpi, absence of auditory foramina on cephalic tibiae and caudal tibiae with medio-internal spur more slender but equal or almost equal in length to the dorso-internal spur.

Type: ♀ ; Porto Bello, Panama. August 18 to 21, 1916. (D. E. Harrower.) [Hebard Collection, Type No. 1102.]

Size averaging slightly smaller, body less elongate, limbs quite similar to those of *acanthoptera*. Fastigium slightly narrower, lateral ocelli separated from each other by a distance slightly over one-half that from one of them to the median ocellus. Palpi short for the Group; ultimate joint with dorsal margin very faintly convex; the apical truncation weakly oblique, its diameter about one-third length of ventral margin. Organs of flight absent. Ovipositor and subgenital plate as given in generic description. Caudal tibiae with spurs slightly more delicate, the dorso-internal much longer, than in that species. Teeth of caudal metatarsus similar but even finer.

General coloration mummy brown, the face with a median streak of buffy below the median ocellus, a subantennal suffusion and below larger subocular suffusion on the genae. In an intensive paratype these paler markings are very greatly reduced, while in a recessive paratype almost all of the face is buffy. Palpi buffy brown, apparently with suffusions of darker. Dorsal surface mummy brown, the pronotum with obscure paler flecks and spots, the mesonotum with caudal margin paler (except in a recessive example) and the abdomen proximad with very faint traces of tessellation. Limbs buckthorn brown with suffused flecks and annuli of mummy brown which occupy most of their surfaces, the metatarsi proximad and second tarsal joint pale, with other portions of the tarsi dark, as in *acanthoptera*.

The measurements of the type are followed by those of two Costa Rican female paratypes, that from La Emilia being given first. Length of body 7, 6.3[8] and 7.5; length of pronotum 1.7, 1.8 and 1.9; length of caudal femur 6.8, 6.6 and 7.3; width of caudal femur 1.7, 1.7 and 2.1; length of ovipositor 4.8, 5.8 and damaged. The antennae in the type are approximately 30 mm. in length.

In addition to the type, we have studied the following material.

[8] Abdomen retracted.

La Emilia, near Guapiles, Costa Rica, 1000 feet, August 24, 1923, (J. A. G. Rehn), 1 ♀, *paratype,* [A. N. S. P.].

Pacayas, Costa Rica, 6000 to 6250 feet, September 6, 1923, (J. A. G. Rehn; from under bark of dead tree), 1 ♀, *paratype,* [A. N. S. P.].

ACLA new genus

This genus is erected to include the single species described as *Heterogryllus crassicornis* by Saussure. That author was in doubt as to the generic association and, from material of the Group now before us, we feel obliged to consider as generically distinct the Brazilian *ocellaris* Saussure, genotype by monotypy of *Heterogryllus.*

The original description of the female of *Heterogryllus* differs from *Acla* in the large lateral ocelli, the dorso-apical median ocellus, the equal dorso-internal and medio-internal spurs of the caudal tibiae and the caudal metatarsi with two rows of spines, those of the outer margin being less numerous. Realization of these differences has led to the assignment of material, now referred to *Acla,* by subsequent authors to the genus *Endacusta* Brunner.

We are satisfied that *Endacusta* Brunner, with genotype *E. irrorata* Saussure, is a genus peculiar to Australia. Though close to *Heterogryllus* Saussure and the allied American genera here proposed, we believe it to be amply distinct, this particularly indicatd by the male tegmina with a triangular mirror, its sinistral vein being longitudinal and the metatarsi carinate ventrad and with two rows of dorsal teeth.

We are able to give the following data on other tropical American species belonging to the Group Heterogrylli.

Material of an additional undescribed species of *Acla,* closely related to *crassicornis,* is before us from Iquitos, Loreto, Peru.

Saussure's Mexican *Endacustes* (an emendation of *Endacusta*) *aztecus,* described in 1897, is clearly a species belonging to or near the genus *Amphiacusta.* That author's concept of the genera involved was evidently vague at the time, his suggestion that the actually very widely separated genera *Endacusta* Brunner and *Endecous* Saussure "might be treated as one" being further proof of this.

Brunner's *Endacustes dispar*, described from St. Vincent in 1892 and Caudell's Peruvian *Endacustes maculata* described in 1918 are members of the genus *Aclodes* here described.

The South American *Ectecous hedyphonus* Saussure, known from Trinidad to the Amazonian region is in some features annectant between *Acla* and *Aclodes,* but in other respects differs widely from either. We here select the male from Cayenne as type of Saussure's *Ectecous cantans,* described in 1897. It is then evident from material at hand that *cantans* falls as a synonym of *hedyphonus.* The female from Orizaba, Mexico, described as *cantans,* can not be placed, but we are convinced that a different genus as well as species is represented.

From paratypes in the author's collection we find that the Peruvian *Endacusta maculata* Caudell, described in 1918 belongs to *Aclodes* here described.

The following features characterize the genus *Acla.* Size medium, body moderately plump, limbs rather short for the Group but elongate if compared with the Group Luzarae. Antennae extremely elongate. Fastigium rostrate, narrow, feebly declivent, the occiput rounding sharply down to its base. Ocelli very small, the lateral separated by a distance about half that from one of them to the median ocellus, which is apical in position and bounded ventrad by a decided depression. Face slightly retreating, forming with the fastigium a subrectangulate angle. Eyes strongly protruding. Palpi elongate, the ultimate joint with expansion strongest distad, its apical truncation very weakly oblique. Pronotum finely medio-longitudinally sulcate and with numerous transverse impressions; ventrocephalic angles of lateral lobes very sharply rounded and subrectangulate or rectangulate. Male tegmina decidedly reduced, their surfaces very finely but thickly hirsute; dorsal fields deplanate with very delicate but fully developed[9] venation, oblique veins numerous, speculum roughly ovoid, crossed by numerous (7 to 9) curved veins; lateral fields with mediastine and humeral veins very heavy, other venation obsolete except very faint traces of oblique branches from the former. Male supra-anal and subgenital plates simple, the latter produced scoop-shaped. Ovipositor elongate, straight or very slightly curved, with apex considerably expanded proximad and much deeper there than wide. Cephalic tibiae with an oval auditory

[9] Such, however, is not the case with an undescribed Costa Rican species which is very probably congeneric, but in which the tegminal reduction is much more decided.

foramen on cephalic faces. Caudal femora robust, with numerous teeth before and between proximal spines but disappearing between distal spines, the proximo-internal of the normal four pairs of strongly alternating spines absent; dorso-external, ventro-external and ventro-internal spurs small, medio-external larger, the medio-internal and dorso-internal decidedly the longest and heaviest. Caudal metatarsus with a dorso-internal row of teeth, the dorso external row represented by a single distal tooth [10].

Acla crassicornis (Saussure)

1878. *H[eterogryllus] crassicornis* Saussure, Mém. Soc. Phys. d'Hist. Nat. Genève, XXV, p. 417. [♂, Venezuela.]

1897. *E[ndacustes] ? darienicus* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 301, p. 7. [[Large juv.] ♂, ♀; Rio Cianati, Darien, Panama.]

1897. *E[ndacustes] apterus* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 301, p. 8. [[Medium juv.] ♂, ♀; Lara River, Darien, Panama.]

We are convinced of the above synonymy from study of the original descriptions and the series now available. The size variation in the species is even greater than that shown by the females described as distinct by Giglio-Tos. The male described as *darienicus* agrees in all respects with a male before us in the instar preceding maturity, that described as *apterus* equally similar to a medium sized immature male at hand.

It is to be noted that whereas Saussure stated that auditory foramina appear only in the adult stage, these organs are as prominent in the half grown immature as in our adults of *crassicornis*. Close examination should, however, have shown Giglio-Tos that his males were not adult.

Andagoya, Antioquia (Chocó), April 22, 1918, (M. A. Carriker, Jr.), 1 ♂, 1 ♀, 1 medium juv. ♂.

The vertical median white bar on the face which forks ventrad is a striking feature of coloration in this species, which also has short, indistinct, well spaced annuli on the antennae proximad.

The insect is known northward as far as Machuca, Nicaragua, and eastward to Venezuela.

[10] In the aberrant Costa Rican species mentioned above with two distal external teeth, while the dorso-internal spur of the caudal tibiae is vestigial.

ACLODES new genus

The genus includes *A. nicuesa* here described Caudell's *Endacustes maculata* and Redtenbacher's *Endacustes dispar,* from the island of St. Vincent, the type of which we have recently seen at the British Museum.

Its superficial resemblance to the new genus *Acla* is great, but closer examination shows very wide difference in the male tegminal venation, presence of tegmina in the female sex, specialized male subgenital plate and caudal femoral armament.

Genotype: *Aclodes nicuesa* here described.

Form, limbs, antennae, fastigium, eyes, palpi, auditory foramina of cephalic tibiae and caudal femora as here described for *Acla.* Size medium to large for the Group Heterogrylli. Lateral ocelli separated by a very brief interval. Pronotum finely medio-longitudinally sulcate, with a broad transverse impression on each side. Tegmina very finely and thickly but inconspicuously hirsute. Male tegmina decidedly reduced, dorsal fields deplanate with very delicate but fully developed venation, oblique veins numerous, speculum pentagonal but roughly oval, with few (1 to 2) irregular transverse veins which sometimes branch and do not curve at their dextral extremities; lateral fields sharply vertical, delimited dorsad by the humeral vein, with mediastine and two or three well developed free veins, the former sometimes branching and with several weak but distinct oblique veinlets distad. Female tegmina reduced, dorsal fields with decided longitudinal veins; lateral fields with unbranched or rarely branched mediastine and two free veins. Male supra-anal plate simple, the subgenital plate with a reflexed triangular lip on the distal margin mesad. Ovipositor weakly curved dorsad, with lanceolate apex broader than deep at its base. Caudal tibiae with teeth moderately well spaced and disappearing between the distal of the four pair of strongly alternating spines; ventro-internal spur very minute or absent [11], dorso-internal and medio-internal spurs of equal length and very elongate, dorso-external and ventro-external spurs small, medio-external decidedly the longer. Caudal metatarsus armed with a few dorsal teeth, the internal row almost or wholly missing except for a terminal tooth.

[11] A minute vestigial ventro-internal spur is present in only one specimen before us of the genotype, but this is the normal condition for *maculatum.*

Aclodes nicuesa new species (Pl. XVI, figs. 1, 2 and 3.)

This cricket, for a species so widely distinct, shows a remarkable similarity in general appearance to *Acla crassicornis* (Saussure). The facial markings, however, alone readily distinguish it, the vertical median band being dark and flanked by three pale vertical bands on each side.

Type: ♂ ; Carrillo, Costa Rica. (C. F. Underwood.) [Hebard Collection, Type No. 1103.]

The following features are of value in addition to those given in the generic description. Lateral ocelli moderately large, round, separated by a distance less than the diameter of one of them, the median placed as described for *Acla*, but at the extreme apex of the fastigium. Tegmina oval, the lateral fields terminating distad in a small lobe. Wings absent. Supra-anal plate with lateral margins roundly notched, the distal portion short and shield-shaped. Subgenital plate with apex rather broad, rounded, curving inward and impressed mesad, where the triangular lip fits in between two chitinous apical nodes of the broad titillators.

Allotype: ♀ ; same data as type. [Hebard Collection.]

Agrees closely with male except as follows. Tegmina represented by decidedly shorter rounded pads, attingent only proximad; of the longitudinal veins the median alone branches, while the discoidal is more raised than the others and separates the dorsal from the lateral field. Ovipositor elongate and weakly curved dorsad, flattening distad, with lanceolate apex broadened only horizontally, so that at its base it is decidedly wider than deep.

General coloration chestnut brown, tegmina and bases of caudal femora often rich auburn. Antennae uniform chestnut brown, except large proximal joint which is pale, individually varying from ochraceous tawny to apricot buff. Face dark brown with two vertical buffy bands on each side of the median dark band which are narrowly separated and fuse ventrad, another vertical band of buffy between face and genae, mouthparts buffy. All but the median pair of these pale bands broken in individuals of more intensive coloration. Palpi buffy suffused with brown. Pronotum blackish chestnut brown, the disk mottled with paler in immature material. Limbs conspicuously annulate and marked with buffy and dark brown.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of tegmen	Width of tegminal dorsal fields	Length of caudal femur	Width of caudal femur
Carrillo, Costa Rica. *Type.*	16.2	3	7.7	5.7	14.7	3.8
Gatun, Panama. *Paratype.*	19.8	3	7.6	5.6	13.1	3.7
Andagoya, Colombia.	15	2.8	7.8	5.8	14.1	3.9
♀						
Carrillo, Costa Rica. *Allotype.*	16	3.2	4.1	——	12.8	3.7

It is not surprising to find the proximal antennal joint very large in this insect, when we consider that the antennae average about 90 mm. in length in adults. The ovipositor measures 11.7 mm.

Specimens Examined: 11; 4 males, 1 female and 6 immature individuals.

Carrillo, Costa Rica, (C. F. Underwood), 1 ♂, 1 ♀, *type, allotype,* [Hebard Cln.].

Gatun, Canal Zone, Panama, July 28 to August 22, 1916, (D. E. Harrower), 1 ♂, *paratype,* 2 juv. ♂, 1 large juv. ♀, [Hebard Cln.].

Barro Colorado Island, Gatun Lake, Canal Zone, Panama, 1924, (J. C. Bradley), 1 juv. ♀, [Cornell Univ.].

Porto Bello, Panama, (A. Busck), 2 juv. ♀, [U. S. N. M.].

Bat Caves on Rio Chilibrillo, Panama, August 29, 1923, (R. C. Shannon), 1 ♂, *paratype,* [U. S. N. M.].

Andagoya, Antioquia (Chocó), Colombia, April 22, 1918, (M. A. Carriker, Jr.), 1 ♂, [Hebard Cln.].

Aclodes maculatum (Caudell) (Pl. XV, fig. 1; pl. XVI, fig. 4.)

1918. *Endacusta maculata* Caudell, Insec. Inscit. Menstr. VI, p. 66, [♂, ♀, juv.; 75° 17′ W, 11° 3′ S, central Peru.]

Our reasons for limiting the genus *Endacusta* to Australian forms are given here under the discussion of our new genus *Acla.*

A paratypic pair of this handsome species is in the author's collection, received in exchange from the National Museum.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia, July 10, 1913, (M. A. Carriker, Jr.), 1 ♀; 4500 feet, July 16 to 24, 1920, (M. Hebard; nocturnal, all found on gravel banks along hillside trail in heavy mountain forest at night with hand flash-light, not common), 3 ♂, 7 ♀.

From the present series it is evident that the female sex possesses tegmina, these so loosely attached that in five specimens one or both have been lost. In all of Caudell's females the tegmina are missing.

In our females the tegmina are similar to those of *A. nicuesa* here described except that they are more reduced, becoming subattingent proximad, while there are distinct cross-veinlets connecting the well elevated longitudinal veins of the dorsal fields. Considerable atrophy in the tegmina is evident and we believe from the variation shown that the insect has evolved from an ancestral form having the mediastine vein well branched. Short delicate distal branches of the mediastine vein are shown by all the males before us, these more evident in those from Colombia in which the degree of tegimal reduction is slightly less. The mediastine vein shows heavy branches as follows: 0 in Peruvian male; 1 and 1 or 2 and 1 in Colombian males; 1 and 1 in three Colombian females; 1 and 0 in two Colombian females; 0 in five Colombian females.

The dorso-internal spur of the caudal tibiae [12] is approximately equal in length to the medio-internal and is approximately half as long as the elongate metatarsus. In the Colombian series the dorso-internal spur is often very slightly shorter, but this difference is not constant and can not be taken as of racial or higher importance.

Like in *nicuesa* the dark head shows traces of pale longitudinal occipital lines and a pale suffused subocular vertical band, but the face usually has a relatively large transverse suffused buffy area which sends a very narrow medio-longitudinal ray dorsad to the median ocellus.

In the eight Colombian females the ovipositor ranges from 17.8 to 20.7 mm. in length.

[12] In the original description inner is given for outer calcars on the fifth line from the bottom of page 67.

Oecanthinae

Oecanthus peruvianus Walker

1869. *Oecanthus peruvianus* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 95. [♂, Peru.]

San Antonio, Cauca, April 14, 1908, 1 ♀.

This female, agreeing closely with the very unsatisfactory original description of *peruvianus*, is seen to represent a species closely related to *O. varicornis* (Walker) [13], differing only in the immaculate proximal antennal joints and the pronotum with ventral portions of lateral lobes broader, more flaring and consequently more conspicuous from above.

Length to apices of wings 19.5, length of body 14, length of pronotum 2.8, greatest total width of pronotum 2, length of tegmen 13, exposed length of wing 2.7, length of ovipositor 4.8 mm.

Caudell has reported this species from Peru in 1918.

Neoxabea trinodosa new species (Pl. XV, fig. 2.)

The present species resembles *N. bipunctata* (DeGeer), differing in the much weaker node of the proximal antennal joint, tegmina with much narrower speculum and veins of lateral fields and dorsal field proximad yellow, less strongly projecting wings and male cerci of similar type but showing differences in proportions and contour. The secondary sexual specialization of the dorsal surface of the male abdomen is, however, by far the most distinctive feature.

Type: ♂; San Antonio, Cauca, Colombia. Elevation 6500 feet. December, 1908. [Hebard Collection, Type No. 1108.]

Size and form as in *bipunctata*. Proximal antennal joint with a small, low node at distal margin. Pronotum similar to that of *bipunctata* but with impressions slightly more decided and vein-like vermiculation of caudal marginal portion much weaker, the narrow lamellate ventral portions of the lateral lobes suddenly expanding meso-caudad in a more triangularly rounded projection. Tegmina more elongate, reaching apices of caudal femora, the speculum decidedly narrower, slightly over one-half as wide as long (instead of almost as wide as long). Wings about equally well developed but projecting less, due to the greater tegminal length. Dorsal surface of abdomen

[13] Represented by a series before us, including localities from Mexico to Panama.

with sixth tergite bearing mesad a large, transverse, sub-bilobate lobe, against the caudal margin of which is pressed the cephalic face of a bluntly triangular node on the seventh tergite, the dorsal surface of which is weakly impressed and flattened; eighth tergite unspecialized; ninth (supra-anal plate) elongate triangular, medio-longitudinally sulcate and with surface of tip shagreenous. Cerci cylindrical, straight and horizontal in proximal three-fifths, then directed weakly dorsad, tapering and with internal surface flattened for half distance to apex, then again horizontal, elongate conical, with acute apex formed by a stout dark tooth. Subgenital plate crushed. Limbs and their armament as in *bipunctata;* lacking teeth or spines and armed distad with two pair of distal spurs, of which the dorso-internal is the longest.

General coloration japan rose; the antennae, two oval areas meso-caudad on pronotal disk, cerci, tibiae and tarsi more buffy. Tegmina transparent, faintly tinged with japan rose except on sutural margin at base of diagonal vein and at apex of first corde where this suffusion is stronger, all the oblique venation of the lateral fields and the veins of the dorsal field as far as the oblique vein mustard yellow.

Length of body 21, length of pronotum 9.2, length of tegmen 12.4, total dorsal width of tegmen 3.9, exposed length of wing 6.8, length of caudal femur 8.1 mm.

Neoxabea intricata new species (Pl. XV, fig. 3.)

Like the preceding species, this insect is particularly distinguished by the specialization of the dorsal surface of the male abdomen.

It also resembles *N. bipunctata* (DeGeer), differing further in the more slender form, virtually obsolete node of the proximal antennal joint and proportionately narrower tegmina with narrower speculum.

The dark caudal portion of the occiput is distinctive, the dark markings of the male tegmina similar to those of *bipunctata* but more pronounced and extensive than in any males of that species before us.

Type: ♂; summit of Sierra San Lorenzo, Magdalena, Colombia. Elevation 8500 feet. July 28, 1920. (J. A. G. Rehn.) [A. N. S. P., Type No. 5439.]

Size as in *bipunctata*, form more slender. Proximal antennal joint with node at distal margin almost obsolete. Pronotum

as here described for *N. trinodosa.* Tegmina failing to reach apices of caudal femora by a considerable interval, narrow, with speculum about four-fifths as wide as long (slightly broader in a paratype). Wings as fully developed and projecting as greatly as in *bipunctata.* Dorsal surface of abdomen with fifth tergite bearing mesad a transverse pair of large, low, circular nodes, sixth with a slightly more adjacent pair of similar but strongly projecting nodes, seventh with a very large and strongly projecting bulbous and somewhat transverse knob with dorsal surface weakly convex, eighth tergite unspecialized, ninth (supra-anal plate) with a large meso-proximal impressed area with a very minute node meso-proximad, the distal portion of the plate rectangularly produced with broadly truncate apex sub-bilobate, its surface shagreenous [14]. Cerci as in that species except that their apices are very sharply rounded and do not terminate in a small dark tooth. Subgenital plate scoop-shaped, subchitinous distad, with a large meso-distal area defined laterad by fine parallel lateral carinae and terminated distad in a subrectangulate median flap just beneath the convex margin of the plate. Limbs as described for *trinodosa.*

General coloration clear ochraceous buff with a faint tawny tinge, the cerci lacking a dark apical tooth. Narrow caudal portion of occiput suffused with russet. Apices of cephalic femora and enlarged proximal portions of cephalic tibiae weakly tinged with russet, the median and caudal femora similarly tinted at their immediate apices. Tegmina and wings transparent, tinged with ochraceous buff and marked with suffusions of darker brown as follows; obliquely in proximal portion of anal field, across distal portions of oblique veins, along diagonal vein and apical margins. These markings are strong, almost mummy brown, in the intensive type, but much weaker in the recessive paratype.

The measurements of the type are followed by those of a paratypic male, taken at Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, Colombia, at about 5000 feet, by H. L. Viereck. An immature male bears the same data and also belongs to the author's collection. Length of body 14.5 and 15.5, length of pronotum 2.9 and 2.8, length of tegmen 11.8 and 11, total dorsal width of tegmen 3.6 and 3.6, exposed length of wing 8.7 and 8.4, length of caudal femur 9.8 and 9.2 mm.

The type was taken while beating the low brush of the summit bald of San Lorenzo near its highest point. Long search failed to discover additional specimens.

[14] In *bipunctata* generally similar, but with a much larger conical projection mesad in the impressed area and distal portion feebly shagreenous only mesad.

TRIGONIDIINAE

Anaxipha stolzmannii (Bolivar)

1881. *Cyrtoxiphus stolzmannii* Bolivar, Anal. Soc. Espanola Hist. Nat., XX, p. 475. [♀; Palmal [,Ecuador].]

Cali, El Valle, May 24, 1914, (H. S. Parish), 1 ♂, 1 ♀, (caudate).

We have recently discussed this widely distributed species[15], known from Cuba and in continental America from Costa Rica to Bolivia.

Anaxipha gracilis (Scudder)

1869. *Trigonidium gracile* Scudder, Proc. Boston Soc. Nat. Hist., XII, p. 331. [♀; Rio Napo [Ecuador or Peru].]

Andagoya, Antioquia (Chocó), April 22, 1918, (M. A. Carriker, Jr.), 1 ♀.

Boca Murindo, Intendencia del Chocó, February 9, 1918, (M. A. Carriker, Jr.), 2 ♀.

This diminutive species is known from Mexico to Brazil.

Anaxipha platyptera new species (Pl. XIV, fig. 2; pl. XVII, fig. 4.)

The nearest known relative of this species is *A. variegata* (Chopard), that insect differing widely in the much narrower male tegmina, transversely banded vertex, annulate antennae, black face, white palpi and differently and much more heavily banded limbs.

For the genus these species are very small, with relatively short limbs, the tegmina of the females facetted, but regularly so and not to the degree found in *A. annulipes* Hebard and *A. nitida* (Chopard).

A multitude of undescribed species of *Anaxipha* in our unstudied tropical American collections show the great need of more than usually complete comparison, measurements and description to avoid future confusion.

Type: ♂; Aracataca, Magdalena, Colombia. August 9, 1920. (M. Hebard.) [Hebard Collection, Type No. 1105.]

Size small, form robust, limbs short for the genus. Head with eyes moderately prominent. Palpi short, the fifth joint expand-

[15] Proc. Acad. Nat. Sci. Phila., LXXVI, p. 233, (1924).

ing strongly distad with width of transversely truncate apex two-thirds length of joint and distinctly less than half the ocular width. Pronotum widening greatly caudad and there forming a low, weakly convex hood above the tegminal bases. Tegmina well surpassing apex of abdomen and extremely broad, the lateral fields in consequence very strongly obliquely retreating to their costal margins; humeral-mediastine area very broad with numerous transverse veinlets, mediastine and two free veins unbranched; dorsal field very broad with speculum as broad as long. Wings strongly caudate (showing no reduction in any of the series). Titillators very broad. Subgenital plate with median projection of caudal margin broad and low, convex. Cephalic tibiae short, the proximal enlargement not decided, gradually narrowing to include about the proximal half; large oval auditory foramina present on both faces. Caudal femora very slightly more slender than in *variegata*. Caudal tibiae with three strongly alternating pairs of delicate and comparatively short spines, the longest not equalling the shortest length between their bases. Caudal metatarsus rather short, the last two tarsal joints about half as long, the longest tibial spur appreciably over half the metatarsal length.

Allotype: ♀; same data as type. [Hebard Collection.]

Appearing considerably smaller, as the tegmina project beyond the abdomen much less both laterad and caudad. Tegminal veins longitudinal, raised and with the transverse cross-veins giving a strongly but regularly facetted appearance, this not as strong as in *variegata*. Wings strongly caudate. Ovipositor much as in *variegata* except that the thickening is less distal, nearly median; comparatively short and broad, curved moderately distad with margins slightly produced at thickening, thence very finely serrulate to the acute apex. Subgenital plate bilobate, but showing scarcely any meso-distal cleft.

Head and pronotum individually auburn to chestnut brown, the occiput slightly paler, the face very dark. Palpi and antennae buffy, the latter with no trace of annuli. Tegmina shining blackish brown, their immediate apices almost clear hyaline, the females with cross-veinlets narrowly and obscurely buffy. Exposed portion of wings almost as dark and darkest at apices. Limbs buffy with a faint tawny tinge, marked with blackish brown as follows: cephalic and median femora with a narrow suffused band meso-distad on cephalic faces; caudal femora with a dorsal-proximal area on both faces, broad transverse median annulus, a faint meso-distal median transverse band on external face and genicular areas; cephalic and median tibiae with proximal, distal and broad median suffusions on extensor faces;

caudal tibiae with a weak and narrow proximal annulus, beyond this often with all of dorsal surface suffused except toward the spine bases. Ovipositor tawny buff.

Length of body ♂ 5.7, ♀ 5; length including wings ♂ 9.8, ♀ 8.7; length of pronotum ♂ 1, ♀ .97; total caudal width of pronotum ♂ 2.6, ♀ 1.47; length of tegmen ♂ 6.2[16], ♀ 4.4; width of dorsal fields of male tegmina 3.2; length of exposed portion of wing ♂ 2.7, ♀ 3.1; length of caudal femur ♂ 4.8, ♀ 4.7; length of longest caudal tibial spine ♂ .34, ♀ .34; length of caudal metatarsus ♂ .8, ♀ .8; length of ovipositor 1.68 mm.

Specimens Examined: 35; 16 males, 18 females and 1 immature individual.

Pozo Azul de Pirris, Costa Rica, May 10, 1920, (M. A. Carriker, Jr.), 1 ♂, [Hebard Cln.].

Tabernilla, Canal Zone, Panama, May 1 to June 21, 1907, (A. Busck), 9 ♂, 10 ♀[17], [U. S. N. M.].

Barro Colorado Island, Gatun Lake, Canal Zone, Panama, April, 1924, (J. C. Bradley), 2 ♀, [Cornell Univ.]; June 23 to July 18, 1924, (N. Banks), 1 ♂, 2 ♀, [Mus. Comp. Zool.].

Rio Trinidad, Panama, March 17 and 23, 1912, (A. Busck), 2 ♂, 2 ♀, [U. S. N. M.].

Aracataca, Magdalena, Colombia, August 5 to 13, 1920, (Rehn and Hebard; in dense, high forest, in dead leaf of "Platanillo" and a colony under loose bits of bark on buttress roots of "Macondo" tree), 3 ♂, 2 ♀, *type, allotype, paratypes,* 1 juv. ♀, [Hebard Cln. and A. N. S. P.]

PHYLLOSCYRTUS Guérin

1844. *Phylloscyrtus* Guérin, Inconogr. Regne Anim., Ins., p. 333. Genotype, by monotypy,—*P. elegans* Guérin.

1878. *Thamnoscirtus* Saussure, Mém. Soc. Genève, xxv, p. 490. Genotype, selected by Rehn in 1904,—*Phylloscyrtus cicindeloides* Gerstaecker.

The above synonymy was caused by Saussure's failure to recognize the correct position of *elegans,* genotype of *Phylloscyrtus.*

The species *elegans* and *cicindeloides* are very close and, as a result, the name *Thamnoscirtus* must fall.

[16] This dimension is considerably increased by the presence of a well developed appendicular field in males of *platyptera.* Though the tegmina are extremely broad compared with their length to apex of speculum, their width compared with the total length is consequently not as great as would otherwise be expected.

[17] The large majority of this series was secured in May.

We are able to locate, as members of *Phylloscyrtus* in its restricted sense; *elegans* Serville, *intermedius* here described, *cicindeloides* Gerstaecker, *vittatus* Gerstaecker, *trinotatus* here described, *viridicatus* (Saussure) and *amoenus* Burmeister, of which all but *cicindeloides* are represented in the Philadelphia Collections.

For part of the genus recognized as *Phylloscirtus* by Saussure, *Cranistus* Stål is available, with genotype the Brazilian *colliurides* Stål. Material before us of *canotus* (Saussure) shows that it also belongs to *Cranistus, macilentus* (Saussure) is evidently an extreme development of that phylum, while *similis* (Bruner) is described as closely related to the genotype.

Moreover *Phyllopalpus* Uhler, with monotypic genotype his *pulchellus,* represents still another valid generic unit. Though showing considerable diversity, material before us of the Mexican *caeruleus* (Saussure) and *brunnerianus* (Saussure), gives evidence that they should be assigned to *Phyllopalpus.*

These genera may be roughly separated as follows:

A. Head short. Pronotum slightly longer than broad.
  B. Eyes moderately projecting. Pronotum without hairy covering. Coloration metallic to different degrees. (North American.) ..... *Phyllopalpus* Uhler

  BB. Eyes more strongly projecting. Pronotum with hairy covering. Coloration not metallic, the males Cicindeloid. (Panama to Argentina.) ..... *Phylloscyrtus* Guérin

AA. Head and pronotum very elongate. (Eyes elongate and moderately projecting. Pronotum without hairy covering. Coloration metallic to different degrees. (South America, south of the Amazonian region.) ..... *Cranistus* Stål

Phylloscyrtus elegans Guérin

1844. *Phylloscyrtus elegans* Guérin, Inconogr. Regne Anim., Ins., p. 333. [♂, Mexico.]

1878. *Phylloscirtus costatus* Saussure, Mem. Soc. Genève, XXV, p. 499. [♀, Colombia [18].]

1897. *Thamnoscirtus montanus* Saussure, Biol. Cent.-Amer., Orth., I, p. 240, pl. 13, fig. 36. [♂; Bugaba, Panama.]

Saussure's failure to recognize *elegans* resulted in the generic confusion discussed above. He afterward did not recognize the

[18] Colombia is here selected as type locality for *costatus.* The Brazilian material originally included clearly represents a different species.

sexes which, though very different in tegminal contour and marking, had already been well characterized by Gerstaecker [19] from Colombian material.

Aracataca, Magdalena, August 3 to 12, 1920, (Rehn and Hebard; in dead leaf of "Platanillo", colony under loose bits of bark on buttress roots of huge "Macundo" tree; all in twilight beneath lofty forest, near ground and usually concealed), 11 ♂, 3 ♀, 1 juv. ♀.

These specimens agree fully with the original description and a Panamanian series now before us.

The striking male tegminal markings are excellently figured by Saussure as the synonymous *montanus*. Of these the proximal and sinistro-median are opaque tawny, the dextro-median translucent but strongly tinged with tawny and the distal opaque tawny sinistrad becoming translucent but strongly tinged with tawny dextrad.

The female is similar in all features of coloration except the tegmina, which are cinnamon brown dorsad with a medio-longitudinal tawny band formed by their sutural margins, the mediastine vein broadly and the interval between the humeral and discoidal veins narrowly sulphur yellow, the lateral fields translucent proximad with suffusions of dark brown distad.

Guérin's type was almost certainly incorrectly labelled "Mexico", as no species of the genus as here defined has since been found north of Panama.

Phylloscyrtus intermedius new species (Pl. XIV, fig. 3.)

This species is intermediate between *P. elegans* Guérin and the Venezuelan [20] *P. cicindeloides* Gerstaecker. From the former it differs in the distinctly less plumose proximal portion of the antennae and the sulphur yellow instead of tawny dorsal markings of the male tegmina.

From *cicindeloides* it differs in the pale occiput, very weakly plumose proximal portion of the antennae and pronotum with lateral bands of disk reaching the cephalic margin.

[19] Ent. Zeit., Stettin, XXIV, p. 427, (1863).

[20] Saussure has discussed material from Caracas, giving Colombia as the country.

With so few features of difference it would appear possible that three races of a single species actually exist. We can state, however, that large series of *elegans* from Panama and Aracataca, Colombia, show no variation in the features mentioned, while in *cicindeloides* the dark occiput and pale cephalic portion of the pronotal disk appear to constitute differences of color pattern sufficient to be taken as indices of specific differentiation.

Type: ♂; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1106.]

Size, form, structure, tegminal venation and limbs as in *elegans*, the pronotal lateral lobes not strongly pinched inward meso-caudad as in the group which includes *viridicatus* (Saussure) and *amoenus* Burmeister. Head and proximal antennal joints ochraceous tawny with a weak (or subsolete) darker interocular line back of which the occiput is slightly paler than elsewhere, the eyes bordered ventrad with yellowish buff. Antennae beyond base with plumose portion black followed by a very broad white annulus, the distal portion dark brown. Palpi blackish brown. Pronotum with two very broad blackish brown longitudinal bands which fuse caudad, leaving a narrow intervening line of light ochraceous tawny[21]; lateral lobes chestnut brown with dorsal margins broadly and ventral margins narrowly sulphur yellow. Tegmina dorsad blackish brown with four areas of sulphur yellow which are homologous to but decidedly less extensive and more clearly cut than those of *elegans*, the periphery narrowly sulphur yellow; lateral fields transparent yellow proximad, distad blackish brown between the broadly sulphur yellow veins and margin. Wings very slightly surpassing tegmina. Abdomen shining blackish brown, cerci similar proximad, thence buffy. Cephalic and median limbs ochraceous buff suffused with tawny and brown. Caudal femora ochraceous buff, externally with a short oblique dorsal and longer longitudinal median streak of dark brown. Caudal tibiae buff dorsad, elsewhere brown, spines and spurs buff proximad and brown distad.

The measurements of the type are followed by those of a male paratype bearing the same data. Length of body 7.7 and 7.6, total length including wings 8 and 8.2, length of pronotum 1.5 and 1.5, length of tegmen 5.1 and 5.2, total dorsal width of tegmina 2.6 and 2.7, length of caudal femur 5.7 and 5.7 mm.

[21] This line expands cephalad in a paratype, breaking completely through the dark lateral bands meso-cephalad.

Phylloscyrtus trinotatus new species (Pl. XIV, fig. 4.)

This handsome species is easily distinguished by the uniform light brown pronotum, immaculate pale limbs except for a short and very weak medio-longitudinal streak externally on the caudal femora and male tegmina solidly shining brown except for three large sulphur yellow areas, two opposed beyond the anal field, one lying across the speculum. These areas are homologous to those of the male sex of *P. intermedius* here described with the proximal pale area omitted.

The antennae in both degree of plumosity and color agree closely with those of *intermedius*.

The hairy covering of head and pronotum is unusually weak dorsad for the genus, but quite as decided laterad and on the pronotal margins as in the other species.

Type: ♂; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1107.]

Size, form, structure, tegminal venation and limbs as in *P. elegans* Guérin. Head and immaculate pronotum a light and polished ochraceous tawny, the eyes bordered ventrad with light buff. Palpi and antennae colored as in *intermedius*. Tegmina dorsad shining, instead of dull as in that species, the pale areas as described above, similarly opaque sinistrad and transparent and less strongly colored dextrad; lateral margins to, but not including, apical portion narrowly yellowish buff; lateral fields transparent yellowish buff proximad, distad blackish brown with free margin, but not veins, broadly light green-yellow. Wings very slightly surpassing tegmina. Abdomen and cerci as in *intermedius*. Limbs clear ochraceous buff with a tawny tinge, immaculate except as follows; caudal femora with a short and suffused longitudinal streak of prouts brown mesad on external faces, caudal tibiae suffused dorsad with prouts brown and spines and spurs this color in distal portions.

Length of body 7.4, total length including wings 8, length of pronotum, 1.5, length of tegmen 5, total dorsal width of tegmina 2.7, length of caudal femur 5.7 mm.

The striking, distinctive and contrasting coloration of *trinotatus* make it one of the handsomest and most outstanding of the new Colombian species we have encountered.

Eneopterinae

Eneoptera surinamensis (DeGeer)

1773. *Gryllus surinamensis* DeGeer, Mém. Hist. Ins., III, p. 519, pl. 43, fig. 1. [♀, Surinam.]

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July 14, 1913, (M. A. Carriker, Jr.), 1 ♀.

Villavicencio, Intendencia del Meta, February, 1920 and 1925, (from A. Maria), 1 ♂, 1 ♀.

This is the most frequently encountered species of cricket, dwelling in the dead leaves of the forest floor from Costa Rica to the Amazonian Region, and found southward to Paraguay and Argentina.

Paroecanthus annulatus (Scudder)

1868. *Eneoptera annulata* Scudder, Proc. Boston Soc. Nat. Hist., XII, p. 140. [♀, Central America.]

Cartagena, Bolivar, July 10, 1920, (M. Hebard; beaten from bushes in dry region of brush), 1 juv. ♀.

Mamatoco, Magdalena, December, 1917, (M. A. Carriker, Jr.), 1 ♀.

This is apparently the only species of the group to which the genotype belongs which invades South America, the included forms being all tropical North American.

Orocharis latifrons Rehn

1909. *Orocharis latifrons* Rehn, Ent. News, XX, p. 211, text fig. [♀; Benque Viejo, British Honduras.]

El Credo, Cauca, 1000 feet, (M. G. Palmer), 1 ♀, [A. N. S. P.].

This is the first South American record for the species, other females of which are before us from Costa Rica and Panama. Males from Panama and Surinam are probably referable to *latipennis*, but the association of the sexes of this species and of *O. cayennensis* Saussure can not be made with certainty until further series have been secured.

A Key to Distinguish *Aphonomorphus, Tafalisca* and the Intervening Genera.

A1. Head normal, in direct cephalic aspect rounded triangular with eyes forming the dorsal angles. Fastigium with lateral margins suddenly declivent proximad, the lateral ocelli there situated, the median ocellus usually on a line between their cephalic margins, which line is frequently slightly indicated in color or contour. Palpi with last joint expanding strongly distad. Contour cylindrical, showing slight to decided tapering cephalad and decided tapering caudad. (Female with apex of ovipositor slender, acute, lanceolate, the valves fusing in such a way that the dorsal valves form the rugose, convex externo-lateral surface and include also the rounded ventral teeth, the ventral valves forming the immediate apex.)

B1. Cephalic tibiae with auditory foramina present on cephalic faces. Caudal tibiae Orocharoid; with fine teeth and slender, movable spines.

C1. Auditory foramina apert, elliptical [22].

Aphonomorphus Rehn.

Genotype.—*A. mutus* (Saussure)

CC1. Auditory foramina conchate [23].

Euaphonus new genus

Genotype.—*E. peruvianus* (Saussure)

BB1. Cephalic tibiae lacking auditory foramina. Caudal tibiae with heavier teeth and less movable, heavier spines. (Female unknown.) .....*Paraphonus* new genus.

Genotype.—*P. cophus* new species

AA1. Head narrow, decidedly deeper than wide, in direct cephalic aspect nearly oval with eyes meso-dorsal in position, the conspicuous occiput arching above them. Fastigium

[22] Thirty two species known to us, many of which are undescribed, are referred to *Aphonomorphus;* all agree in this feature, showing that the auditory foramina are not subject to decided differentiation in the forms here assigned, though such is undoubtedly the case in *Paroecanthus* Saussure. Our reason for recognizing the new genera here described lies in this fact.

It is becoming increasingly evident that characters which clearly indicate generic distinction in some groups, have no more than specific significance in others, while in still other groups the same characters may even be subject to individual variation within a single species.

[23] The tibial inflation in material of *peruvianus* and another undescribed species of the genus before us is such that the term "conchate" much better describes the condition than Saussure's "rimate".

curving evenly laterad, the ocelli often almost obsolete, the median well in advance of the lateral pair. Palpi with last joint elongate, nearly elliptical or infundibuliform. Contour tubular, of nearly the same diameter throughout. (Caudal tibiae with heavy teeth and heavy, fixed spines. Ovipositor valves with apex horizontal, the dorsal and ventral pair forming flat plates functioning independently, the ventral surfaces of the latter with longitudinal carinae [24].)

B2. Form very slender. Cephalic tibiae with apert, elliptical auditory foramina on cephalic faces. Ovipositor with apices of dorsal valves acute and of ventral valves truncate. *Stenaphonus* Saussure.
Genotype.—*S. macilentus* Saussure

BB2. Form slender. Cephalic tibiae lacking auditory foramina. Ovipositor with apices of both dorsal and ventral valves truncate.....*Tafalisca* Walker.
Genotype.—*T. lurida* Walker

The excellent figures and description given by Chopard leave no doubt that *elongatus,* monotypic genotype of his *Pseudogryllus,* is congeneric with *Tafalisca lurida* Walker. Lack of material of the latter species probably led to this synonymy. Moreover the transition from *Aphonomorphus* to *Tafalisca,* through the other genera here discussed, is so evident that we are satisfied that Chopard's subfamily Stenogryllinae is not valid.

Material of the African *forticeps* (Walker), genotype of *Parametrypa* Brunner, indicates that that genus is not closely related to *Tafalisca,* (of which genus *Metrypa* is an established synonym).

The Oriental genus *Aphasius* Saussure plainly has no close affinity to the genera here considered.

Aphonomorphus tumidus (Saussure)

1897. *Aphonus tumidus* Saussure, Biol. Cent.-Amer., Orth., I, p. 282. [♂, Colombia.]

Pensilvania, Cundinamarca, 1914, (from A. Maria), 1 ♀.

The present female appears to agree with the very unsatisfactory original description except in being of a more uniform

[24] The species hitherto referred to *Tafalisca* which have the apices of the ovipositor valves acute and the ventral surfaces of the apices of the ventral valves smooth, including *claudicans* Brunner, *bahiensis* Saussure, *paulista* Rehn and possibly *brasiliensis* Saussure, probably represent one or more closely related but distinct genera.

wood color, with five oblique markings on the tegminal dorsal fields reduced to mere lines, the cephalic tibiae weakly but distinctly inflated opposite the auditory foramina on their caudal faces and the caudal femora armed with five external and six internal spines of which the distal on each side is very close to the spurs. Its palpi are missing.

The insect represents one of the large and comparatively slender species of the genus, related to *A. conspersus* Bruner and several other undescribed South American species in the material before us.

Length of body 20, length of pronotum 3.9, length of tegmen 24.3, exposed length of wing 5.9, length of caudal femur 16.1, width of caudal femur 4, length of ovipositor 19 mm.

PARAPHONUS new genus

In this genus is placed *cophus* here described and *Metrypa bogotensis* Saussure, of which we designate the former as genotype.

Affinity to *Aphonomorphus* Rehn is shown on one hand and on the other to *Tafalisca* Walker. The shape of the head, arrangement of the ocelli, form of the palpi, ovipositor and general contour are like the former; the lack of auditory foramina like the latter, while the spines of the caudal tibia are also much more like those of *Tafalisca*.

The genus is further characterized in the above key.

Paraphonus cophus new species (Pl. XVII, figs. 5 and 6.)

This insect is even paler than *Aphonomorphus silens* (Saussure), with which species it agrees in general coloration, differing further in the generic features discussed above and in the decidedly shorter tegmina, wings and limbs.

Type: ♂; near summit of Sierra San Lorenzo, Magdalena, Colombia. Elevation 8000 feet. August 23, 1913. (M. A. Carriker, Jr.) [Hebard Collection, Type No. 1116.]

Size medium, form robust; tegmina, wings and limbs short when compared with the normal for *Aphonomorphus*. Eyes large, moderately protuberant, oblique. Interocular area before ocelli depressed and faintly concave. Lateral ocelli round,

small, flat, the median very small and indicated only in color. A slightly raised band runs transversely from the eye to the lateral ocellus with a feeble juxta-ocular node, includes that ocellus and is there oblique, thence again transverse to the other lateral ocellus, with median ocellus placed in it. Fastigio-facial projection rounded, slightly narrower than proximal antennal joint. Palpi elongate; ultimate joint expanding decidedly, its dorsal margin weakly concave and oblique distal margin feebly convex and almost equal in length to the straight ventral margin, with which it forms a rightangle. Pronotum with caudal margin very weakly convex mesad and feebly concave laterad. Tegmina falling slightly short of the apices of the short and robust caudal femora, the dorsal surface with a very weak network of veinlets between the veins showing a strong longitudinal tendency. Wings very slightly surpassing tegmina. Subgenital plate moderately elongate scoop-shaped, with apex subchitinous and bilobate, meso-distad with a short impressed hirsute area. Concealed genitalia extremely complex. Cephalic tibiae becoming more slender proximad with no trace of impression or convexity. Caudal tibiae with five pair of stout spines, numerous stout spiniform teeth and three pairs of stout spurs of which the dorso-internal is nearly as long as the metatarsus. Caudal metatarsus short, with (normally) two (but sometimes one) dorso-external teeth before a pair of very large teeth which precede the distal pair of spurs, the longest of which latter not reaching a median point on the last tarsal joint.

Allotype: ♀; near summit of Sierra San Lorenzo, Magdalena, Colombia. Elevation 7900 feet. July 30, 1920. (M. Hebard.) [Hebard Collection.]

Very similar to male, larger and more robust. Closely resembling an undescribed species of *Aphonomorphus* near *mutus*, which inhabits the same region, in appearance differing only in being slightly more robust and shorter, with veins of dorsal fields of tegmina more regular, less oblique and more prominent and the cross-veinlets weaker. Tegmina reaching apices of caudal femora and very briefly surpassed by the wings. Ovipositor with shaft heavier than usual in *Aphonomorphus*, broadly and not strongly decurved, the apex lanceolate, Aphonomorphoid but with dentate ventral surface more heavily so. Subgenital plate with sides convergent to the moderately concave apex which embraces the rather broad base of the ovipositor.

Head, antennae, pronotum and limbs buckthorn brown, the palpi more buffy, the caudal tibiae and caudal femora distad slightly darker with a russet tinge. A narrow line of buffy

runs from eye to eye throughout the ocelli, this being sometimes subobsolete, the feebly concave interocular region preceding it suffused, cinnamon brown. Tegmina paler buckthorn brown with a series of minute brown flecks distad on the discoidal vein, which in one specimen are dark brown and more conspicuous.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of tegmen	Exposed length of wing	Length of caudal femur	Width of caudal femur	Length of ovipositor
Type.	18.7	3.4	16.3	.7	13.4	3.8	
Paratype.	19.1	3.7	16.8	.8	13.8	4	
Paratype.	20	3.9	16.3	.7	14	4	
♀							
Allotype.	21	4	19.7	1.8	14.4	3.8	14.7
Paratype.	19.1	4	19.1	1.7	14.1	3.9	14.1
Paratype.	18.4	3.8	17.7	2.2	13.7	3.8	13.4

Specimens Examined: 6; 3 males and 3 females.

Near summit on western slope of Sierra San Lorenzo, Magdalena, Colombia, 6800 feet, July 30, 1920, (J. A. G. Rehn; under loose bark), 1 ♀, *paratype*, [A. N. S. P.]; 7900 feet, July 30, 1920, (M. Hebard; under loose dead dry bark of sapling in low thick forest of upper mountain slopes), 1 ♂, 1 ♀, *paratype, allotype;* 8000 feet, August 23, 1913, (M. A. Carriker, Jr.), 2 ♂, *type* and *paratype*.

Mogoplistinae

Cycloptilum antillarum (Redtenbacher)

1892. *E[ctatoderus] antillarum* Redtenbacher, Proc. Zool. Soc. London, 1892, p. 218, pl. 17, figs. 16a and 16b. [♂, ♀; windward side of St. Vincent [, British West Indies].]

Cartagena, Bolivar, July 10, 1920, (Rehn and Hebard; beaten from bushes in region of heavy dry scrub), 2 juv. ♀.

Puerto Colombia, Atlantico, July 11 and 12, 1920, (Rehn and Hebard; beaten from foliage of dry hillside scrub forest), 3 ♂, 1 large juv. ♀.

As in Panamanian males before us, these adults have the cephalic width of the pronotum contained distinctly over twice in its length.

Cycloptilum annulatum new species (Pl. XVI, figs. 5 and 6.)

This species agrees closely with *C. antillarum* (Redtenbacher), differing mainly in having the maxillary palpi longer and differently proportioned, the antennae and tibiae annulate[25], the dorsal fields of the male tegmina having a broad caudal portion exposed and the ovipositor of the female considerably shorter than the caudal femur. The species is further distinguished by the male pronotum being proportionately less produced caudad and the dark marginal band of the dorsal fields of the tegmina having a pale marginal area on each side.

Nearest to it is *C. scotops* here described, under which species a full comparison is given.

Type: ♂ ; Aracataca, Magdalena, Colombia. August 11, 1920. (M. Hebard.) [Hebard Collection, Type No. 1117.]

Size averaging smaller and form very sligthly less robust than in *antillarum*. Head seen from the side gradually curving to fastigium, the latter with dorsal margin moderately declivent to the point where it rounds into the vertical face at slightly more than a right angle[26]. Fastigium roundly produced but appreciably less bulbous than in *antillarum*, with only a trace of a medio-longitudinal sulcus and with a strong proximal transverse sulcus. Labrum decidedly impressed dorso-laterad as in that species. Palpal joints distinctly longer and more slender. Maxillary palpi with fifth and third joints of equal length, the fourth slightly longer (unusually elongate for the genus); fifth expanding evenly to the weakly truncate apex, the diameter there being scarcely two-fifths the greatest (dorsal) length of the joint. Pronotum narrowing weakly cephalad, with caudal production much less than in *antillarum*, the caudal margin broadly convex. Tegmina with broad caudal portion exposed as far as apex of angulate vein of speculum; speculum with surface longitudinally plicate and with an angulate vein, the angulation of which is situated meso-cephalad and is sharply rounded at less than a rightangle; lateral fields considerably more exposed than in *antillarum*, the discoidal vein alone present and curving distad to the humeral vein, the discoido-humeral area wholly visible. Cerci elongate, but shorter than in many

[25] This annulation is derived from the covering of scales and consequently disappears when that is lost. The scales are as easily abraided as those on the wings of a butterfly.

[26] In *antillarum* the dorsal surface of the head is nearly horizontal, the fastigium with its dorsal surface the same to the point where it rounds into the vertical face, there forming a rightangle.

species of the genus. Genitalia, without dissection, apparently as in *antillarum*. Cephalic tibiae with cephalic face bearing an oval auditory foramen dorso-proximad, as in that species. Caudal tibiae and tarsi similar, the longest tibial spur (medio-internal) almost half as long as the rather elongate and little thickened metatarsus, the longer (inner) metatarsal spur over three-fifths as long as the terminal tarsal joint.

Allotype: ♀; same data as type. [Hebard Collection.]

Generally similar to male except as follows. Pronotum simple, tubular, truncate caudad. Tegmina absent. Ovipositor similar to that of *antillarum* but considerably shorter. Subgenital plate weakly bilobate distad, the meso-distal emargination being shallow and strongly obtuse-angulate.

General coloration reddish brown becoming blackish on abdomen. Insect, except on face, antennae, palpi, tegmina and ovipositor, heavily coated with metallic dark brown and silvery scales, the abdomen (rubbed and consequently unicolorous in most specimens) appearing to be somewhat mottled dorsad but without pale transverse bands, the femora dark brown with numerous silvery flecks, the tibiae and tarsi with broad and striking annuli of dark brown and silver [25]. Antennae yellowish buff with conspicuous but very small and widely spaced annuli of very dark brown. Proximal antennal joints and facial protuberance suffused with deep liver brown, this darkening by no means as deep or as extensive as in *scotops*. Palpi deep liver brown, buffy at intersections of three terminal joints and ventrad on third joint. Male tegmina transparent tinged with light yellowish buff: the ventral margin of the lateral fields white, followed by a broad longitudinal band of chestnut; the dorsal fields also broadly margined distad with chestnut, with a marginal area mesad on each side of light yellowish buff. This marking is particularly useful in distinguishing *annulatum* from its nearest allies.

Measurements (in millimeters)

	Length of body	Length of pronotum	Caudal width of pronotum	Exposed length of tegmen	Length of caudal femur	Width of caudal femur	Length of ovipositor
♂							
Type.	7.1	3.4	2.2	1.1	5	1.8	——
Paratype.	7.2	3.6	2.3	1.1	5.1	1.9	——
♀							
Allotype.	7.3	2.3	2	——	5.2	2	3.6
Paratype.	7.7	2.4	2.1	——	5.3	2	3.8

Specimens Examined: 15; 6 males, 7 females and 2 immature individuals.

Puerto Colombia, Atlantico, July 12, 1920, (M. Hebard; in dead leaves under brush of dry scrub forest on summit of plateau, in same spot that *C. thoracicum* here described was secured), 1 ♀, *paratype*, 2 juv.

Aracataca, Magdalena, August 4 to 13, 1920, (M. Hebard; beaten from low undergrowth of lofty forest and there in dead leaves and litter), 6 ♂, 6 ♀, *type, allotype, paratypes.*

Cycloptilum scotops new species (Pl. XVI, fig. 7.)

This species is closely related to *C. annulatum* here described from the same locality, agreeing in the elongate fourth joint of the maxillary palpi, the male tegmina having a broad caudal portion exposed, the ovipositor length and form of the female subgenital plate.

In size *scotops* averages slightly larger, with form slightly more elongate. The antennal and limb annulations are much weaker and the head is strikingly darker. The palpi are paler with fifth joint slightly shorter. The distal dark band of the dorsal fields of the male tegmina is solid.

Type: ♂ ; Aracataca, Magdalena, Colombia. August 4, 1920. (M. Hebard.) [Hebard Collection, Type No. 1119.]

Agrees closely with *annulatum* except as noted above and as follows. Palpal proportions very similar except that the fifth joint has its apical diameter one-half the longest (dorsal) portion of the joint. Cerci very elongate (9.5 mm.), considerably longer than in *annulatum.*

Allotype: ♀ ; same data as type but taken August 9, 1920. [Hebard Collection.]

Differs from male as does this sex of *annulatum.* Separable from this sex of that species only by the palpal proportions, very slight differences in size and form, but important differences in coloration of head, antennae, palpi and limbs. The ovipositor in these species is considerably shorter in proportion to the caudal femoral length than in *C. antillarum* (Redtenbacher).

Coloration important for diagnosis. General color reddish brown, becoming blackish on abdomen. Insect, except on face, antennae, palpi and tegmina, heavily coated with metallic light brown and silvery scales, the abdomen (rubbed and consequently unicolorous in most specimens) appearing to be somewhat mottled dorsad but without pale transverse bands, the genae and the sides of pronotum silver, the femora with contrast

between the pale (flecks) and (generally) dark scales less marked than in *annulatum*, the tibiae and tarsi with broad annuli of brown and silver which are not as striking as is normal for that species. Antennae yellowish buff with inconspicuous, very small and widely spaced annuli of brown. Palpi buffy with sides of third and fourth and apex of fifth joint weakly suffused with liver brown. Proximal antennal joints, facial protuberance and all of face strikingly solid blackish liver brown. Male tegmina transparent tinged with light yellowish buff, the ventral margin of the lateral fields white, followed by a broad longitudinal band of chestnut; the dorsal fields also broadly and solidly margined distad with chestnut.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotum	Exposed length of tegmen	Length of caudal femur	Width of caudal femur	Length of ovipositor
Type.	8.8	3.9	2.6	1.2	6.4	2.1	——
Paratype.	8.3	3.6	2.3	1.3	5.9	1.9	——
♀							
Allotype.	7.8	2.3	2.1	——	5.6	1.8	3.7
Paratype.	7.8	2.3	2	——	5.7	2	3.8

Specimens Examined: 10; 5 males and 5 females.

Aracataca, Magdalena, August 4 to 13, 1920, (M. Hebard; beaten from low undergrowth of lofty forest and there in dead leaves and litter in company with *C. annulatum*), 5 ♂, 5 ♀, *type, allotype, paratypes.*

Cycloptilum thoracicum new species (Pl. XVI, fig. 8.)

Though among the described American species[27] there are apparently none closely resembling *thoracicum*, it is best comparable with the Floridian *C. zebra* (Rehn and Hebard). The size is even smaller, *thoracicum* being the smallest known American species. In the male sex it may be easily distinguished by the much greater production caudad of the pronotum which conceals the tegmina from above[28] and leaves exposed only the

[27] The species at present referred to *Cycloptilum* are all American, but among the Old World forms of the Mogoplistinae, at present referred to other genera, it appears highly probable that a number are congeneric.

[28] Except very narrowly latero-caudad.

distal portion of the abdomen, *thoracicum* also having the greatest pronotal development in this sex of the described American species. The head is quite similar to that of *zebra* except that the fastigium is narrower and the palpi show different proportions.

Type: ♂ ; Hacienda Bolivar, Magdalena, Colombia. July 15, 1920. (M. Hebard.) [Hebard Collection, Type No. 1118.]

Size very small, form graceful. Head with dorsal surface nearly horizontal, the fastigium with dorsal surface the same to point where it rounds rather broadly into the face at slightly less than a rightangle, as the face retreats slightly to that point. Fastigium roundly produced and bulbous, with a fine but distinct medio-longitudinal sulcus which becomes very weak dorso-proximad and with a strong proximal transverse sulcus. Labrum moderately impressed dorso-laterad. Maxillary palpal joints not elongate, the ultimate considerably shorter than in *zebra;* three last joints approximately equal in length, ultimate with truncate apex very feebly oblique, its diameter there approximately three-fifths the longest (dorsal) portion of the joint. Pronotum narrowing weakly cephalad in cephalic portion, its lateral margins in large produced portion parallel and then showing a very weak convergence to convex caudal margin; its surface convex, this becoming weak dorso-caudad but not as weak there as in *zebra* in spite of the greater production and with no trace of the flattening there found in *C. squamosum* Scudder. Tegmina completely concealed dorsad except the narrow disto-lateral margins; lateral fields ample, very broad, embracing body, the discoidal vein alone present and bent suddenly distad to join the humeral vein, the discoido-humeral area wholly visible[29]. Cerci missing. Genitalia, without dissection, apparently of the same type as in *C. antillarum* (Redenbacher); the two projecting fingers elongate, straight and slender, in lateral aspect more slender than in *zebra* and not showing expansion (which becomes strongest meso-distad in that species). Cephalic tibiae with cephalic face bearing a broadly oval auditory foramen dorso-proximad. Caudal tibiae and tarsi of same type found in *antillarum*, the longest (medio-internal) tibial spur appreciably less than half as long as the moderately elongate and little thickened metatarsus, the longer (inner) metatarsal spur three-quarters as long as the terminal tarsal joint.

[29] All but the proximal portion of the lateral fields of the tegmina are protected by the caudal femora.

No adult females are before us, immature individuals of that sex from Cartagena showing scarcely any trace of emargination of the subgenital plate.

General ground coloration buckthorn brown or slightly darker, the briefly exposed proximo-lateral portion of the abdomen of very slightly deeper shade. Face and last three joints of maxillary palpi flecked with brown. Antennae yellowish buff with mere traces of very small and widely spaced brown annuli, (these deeper and much more conspicuous in the immature specimens). Exposed portions of male tegmina mummy brown, the ventral margins of the lateral fields broadly whitish, like ground glass; covered portions of tegmina similarly whitish. Femora mottled and tibiae and tarsi weakly annulate, the distal half of the ultimate tarsal joint dark, brown. In the immature individuals the limb annuli are decidedly more evident. The scale covering is largely silvery, brown scales forming the darker limb markings.

The measurements of the type are followed by those of a male paratype from Puerto Colombia. Length of body 4.9 and 5.6 (abdomen extruded), length of pronotum 3.8 and 4.1, greatest (meso-caudal) width of pronotum 1.9 and 2, length of caudal femur 3 and 3.1, width of caudal femur .9 and 1 mm.

Specimens Examined: 4; 2 males and 2 immature individuals.

Cartagena, Bolivar, July 10, 1920, (Rehn and Hebard; beaten from bushes in area of dry scrub), 2 juv ♀.

Puerto Colombia, Atlantico, July 12, 1920, (J. A. G. Rehn; in dead leaves under brush on dry summit of plateau in company with *C. annulatum* here described), 1 ♂, *paratype*, [A. N. S. P.].

Hacienda Bolivar, Santa Marta, Magdalena, July 15, 1920, (M. Hebard; beaten from green sapling on arid hillside), 1 ♂, *type*.

Gryllotalpinae

We find considerable confusion in the literature covering *Scapteriscus didactylus* and its allies. We believe that three very closely related species may be recognized, though it must be admitted that further studies may show that one or even two of these are races or only variants of a single plastic species. At present we distinguish them as follows.

A. Size averaging larger. Pronotum proportionately broader. Ventro-external margin of cephalic femora strongly convex, this followed by a decided rectangulate emargination.

  B. Pronotal discal darkening usually less extensive and strongest medio-longitudinally. Cephalic tibial dactyls separated at base by a narrow interval... *vicinus* Scudder

BB. Pronotal discal darkening usually extensive, often darker laterad than mesad, with pattern less apparent. Cephalic tibial dactyls separated at base by a broader interval. ..... *tetradactylus* (Perty)

AA. Size averaging smaller. Pronotum proportionately narrower. Ventro-external margin of cephalic femora weakly convex, this followed by a broadly obtuse-angulate emargination. (Pronotal discal darkening usually extensive, sometimes with pale meso-lateral flecks. Cephalic tibial dactyls as in *tetradactylus*..... *didactylus* (Latreille)

Scapteriscus didactylus (Latreille)

1803. *Gryllo-talpa didactyla* Latreille, Nouv. Dict. d'Hist. Nat., 1st Ed., VI, p. 446 and VII, pl. DI, fig. 9. [Cayenne; Surinam.]

1804. *Gryllotalpa didactyla* Latreille, Gen. Crustac. Ins., XII, p. 122. [Cayenne; Surinam.]

Latreille's figure is unsatisfactory but indicates an insect with narrower pronotum, as figured in color by Guerin, which figure was copied by Gray in Griffith. On the other hand the records of *didactyla* by Burmeister and Serville can not be placed, Saussure's appear referable to *vicinus* and Scudder's and Rehn's are probably part correct and part referable to *S. tetradactylus* (Perty). Though the latter has been generally placed as a synonym of *didactyla*, Perty's figures shows it to be a heavier insect and we believe that it is actually the species which has been generally recognized as *S. camerani* Borelli.

Muzo, Boyacá, 1921 and 1922, (from A. Maria), 1 ♂, 4 ♀, 1 juv.

Pacho, Cundinamarca, March, 1917, (from A. Maria), 1 ♂.

These specimens are very dark, the two males with tegmina falling short of the caudal femoral apices by a brief distance and wings not showing.

Material of this species is also before us from Costa Rica, western Ecuador, Venezuela, British and Dutch Guiana, Brazil in the vicinity of Pará, Bolivia, Paraguay and the Argentine[30].

As noted by Rehn and Hebard in 1916, *S. vicinus* Scudder is very closely related, differing in addition to the characters there given in its average larger size and ventro-external margin of the cephalic femora with convexity and meso-distal emargination decidedly more pronounced.

[30] Material from Sapucay, Paraguay and Buenos Aires, Argentina, recorded as *camerani* by Rehn in 1907, we here refer to *didactylus*.

Scapteriscus tetradactylus (Perty)

1832. *Gryllotalpa tetradactyla* Perty, Delect. Anim. Artic., p. 118, pl. 23, fig. 8. ["In mediterraneis Prov. Minarum".][31]

1894. *Scapteriscus camerani* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, IX, No. 184, p. 45. [♂, ♀; Province of San Pedro and Asuncion, Paraguay.]

From the robust form of *tetradactyla* as figured by Perty, we were satisfied if *vicinus* and *camerani* represented species distinct from *didactylus*, one of them was a synonym of *tetradactylus*, instead of that name being a synonym of *didactylus* as has been generally supposed. Considering the evidence further we find the type locality of *tetradactylus* to be within the known range of distribution of *camerani* and south of that occupied by *vicinus* as indicated by the collections now before us. We consequently consider *camerani* a synonym of *tetradactylus*. At the time *camerani* was described neither of the names *tetradactylus* or *vicinus* were considered.

Fusagasugá, Cundianamarca, December, 1916, (from A Maria), 1 ♀.

We have before us material which we refer to this species from Kartabo, British Guiana; Belem and Igarapé-Assú, Pará[32], 100 knots west of Santarem on the Amazon[33] and 500 miles up the Madeira, Brazil[33].

Material probably referable to the species has been recorded as *camerani* from Gualaquiza and the Valley of Santiago, eastern Ecuador. Scudder's records of *didactylus* are probably part referable to *tetradactylus*.

For this insect, as the synonymous *camerani*, the close affinity to *didactylus* has been observed, but the even closer relationship of *vicinus* had not been previously noted.

[31] The state of Minas Geraes, Brazil.

[32] The series recorded, in part correctly, as *S. didactylus*, by Rehn, Proc. Acad. Nat. Sci. Phila., 1918, p. 207.

[33] This material was recorded as *camerani* by Rehn in 1917, Trans. Amer. Ent. Soc., XLIII, p. 123.

Scapteriscus vicinus Scudder

1869. *Scapteriscus vicinus* Scudder, Mem. Peabody Acad. Sci., I, p. 12, pl. 1, figs. 4 and 23. [♂; Rio Negro, Brazil [34].]

Scudder's *agassizii* was placed as a synonym by Rehn and Hebard in 1916. Saussure's comments on *didactylus* in 1874 are found to refer instead to the present insect.

Though the differences between *vicinus* and *didactylus* have been discussed, the even closer relationship of the former to *tetradactylus* (synonym *camerani*) has never been noted. Only weak characters are to be found to distinguish these species and we have given all in the present key which appear to be of value.

El Tambo, Intendencia del Chocó, March 30, 1918, (M. A. Carriker, Jr.), 1 ♀.

Rio Tamaná, Chocó, (M. G. Palmer), 1 ♀, [A. N. S. P.].

Cordoba, El Valle, May 22, 1918, (M. A. Carriker, Jr.), 1 ♂.

A female from Quibdo, Cauca, recorded by Rehn in 1917, is in the Academy collection. We have also considerable series of *vicinus*, recorded by Rehn or Rehn and Hebard from the southeastern United States; the West Indies; Caicara, Venezuela, and the Rio Pacaya, Peru.

We have been able to verify records from as far south as the Rio Negro, Brazil and the Rio Pacaya, Peru. Bruner's records from Bolivia and the Argentine are decidedly questionable. Though large unstudied collections from those regions are before us, the only material of *Scapteriscus* represents *didactylus*.

Gryllotalpa hexadactyla Perty

1832. *G*[*ryllotalpa*] *hexadactyla* Perty, Delect. Anim. Artic., Brasil., p. 119, pl. 23, fig. 9. [Mountains of Minas Geraes, Brazil.]

Muzo, Boyacá, 1921, (from A. Maria), 1 ♀.

Though known from Ontario to Peru and Brazil, this species is rarely encountered in numbers.

Tridactylinae

Ripipteryx pulicaria Saussure

1896. *Rhipipteryx pulicaria* Saussure, Biol. Cent.-Amer., Orth., I, p. 215, pl. 11, fig. 24. [♂, ♀; Dos Caminos in Guerrero, Atoyac in Vera Cruz, Teapa in Tabasco, Mexico.]

Cartagena, Bolivar, July 10, 1920, (Rehn and Hebard; common on the bare soil margining a stagnant pool in the area of dry scrub), 3 ♂, 6 ♀, 2 juv. ♀.

[34] Selected as single type by Rehn in 1917. The other specimens of Scudder's original series must be examined before the specific identity of each can be satisfactorily established.

These specimens agree very closely with a Panamanian series which we will discuss in the near future. The most striking difference in coloration lies in the wings which, when folded, have their dorsal surface and dorsal and ventral margins largely or in part dark brown, but the lateral surfaces clear milky white with a decided mother-of-pearl iridescence.

The species is found through Central America as far north as Vera Cruz, Mexico, but we have reason to believe that the South American records previously given are referable to superficially similar but distinct, allied species.

Ripipteryx carbonaria Saussure

1896. *Rhipipteryx carbonaria* Saussure, Biol. Cent.-Amer., Orth., I, p. 211. [♀; Volcano of Chiriqui, Panama.]

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, 4500 feet, July 10, 1913, (M. A. Carriker, Jr.), 1 ♂, 3 ♀.

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, December 16, 1922, (H. L. Viereck), 2 ♀, 1 juv. ♂.

The previously unknown male, compared with that of *R. forceps* Saussure, is seen to differ widely in the genitalia, the subgenital plate being less specialized and of different contour, the elongate processes of the ventral valves (anal appendages of Saussure) much more highly specialized. These latter expand in dorsal portion distad with the large truncate apices showing a caudal surface which is flattened below and moderately concave and wider above, while from the ventro-internal surface of the shaft meso-distad springs a small knob which projects as far as does the shaft. At the base of the anal appendage is a fine recurved fang on each side of the semicircular supra-anal plate, the dorsal surface of the latter being evenly concave. The subgenital plate narrows gradually, rounding into a truncate apex of moderate width; its surface is convex in proximal three-fifths, shallowly and extensively concave on each side distad, so that between is a distal slightly thickened area occupying part of the truncate projection, the proximal margins of this thickening being strongly concave-convergent and thence forming a fine carina between the lateral concave areas.

A large Costa Rican series of the species is also before us, including a specimen determined as *carbonaria* by Saussure.

Ripipteryx forceps Saussure

1896. *Rhipipteryx forceps* Saussure, Biol. Cent.-Amer., Orth., I, p. 210, pl. 11, fig. 23. [♂, ♀; Colombia.]

Almaguer, Cauca, 10,500 feet, March 11, 1912, (Lloyd), 3 juv. ♂, 1 juv. ♀.

La Pica, Santander, 9000 feet, February 10 to 15, 1917, (M. A. Carriker, Jr.), 1 ♂, 3 ♀.

Saussure's supposition that *forceps* would be found in Panama and Costa Rica is probably incorrect. It is a species of higher elevations than *R. carbonaria* Saussure, a factor which has apparently prevented its reaching those regions.

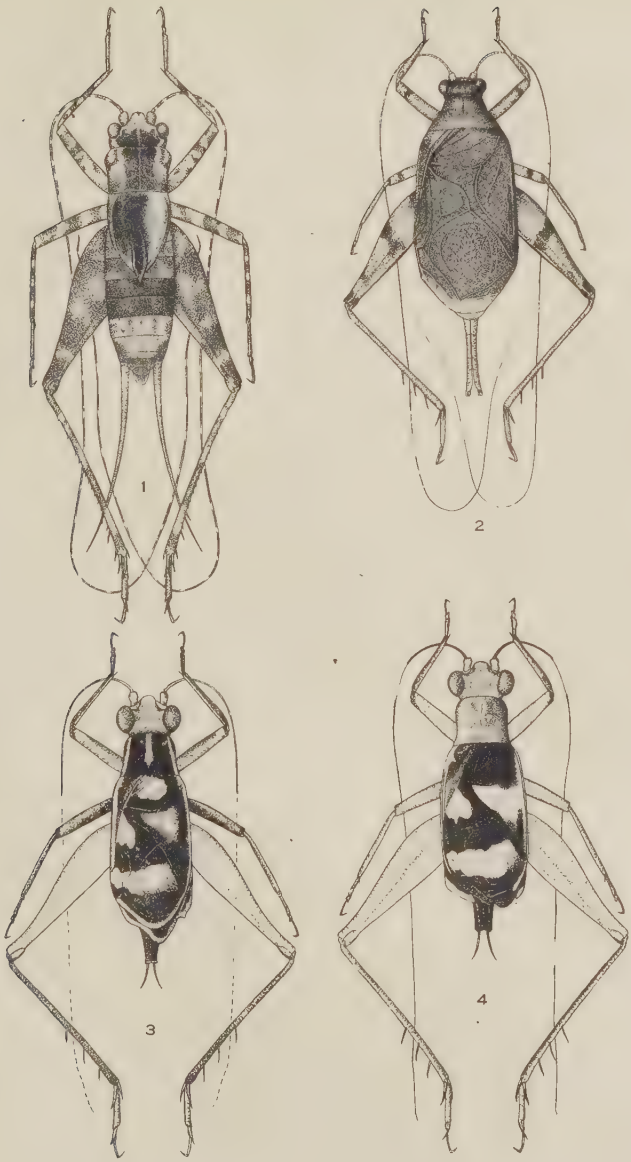
PLATE XIV

Fig. 1.—*Eugryllina acanthoptera* new species. Dorsal view of male. Between Hacienda Cincinnati and Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, Colombia. *Type.* (Slightly under X 4.)

Fig. 2.—*Anaxipha platyptera* new species. Dorsal view of male. Aracatacà, Magdalena, Colombia. *Type.* (Slightly under X 5.)

Fig. 3.—*Phylloscyrtus intermedius* new species. Dorsal view of male. Andagoya, Antioquia (Chocó), Colombia. *Type.* (Slightly under X 5.)

Fig. 4.—*Phylloscyrtus trinotatus* new species. Dorsal view of male. Andagoya, Antioquia (Chocó), Colombia. *Type.* (Slightly under X 5.)



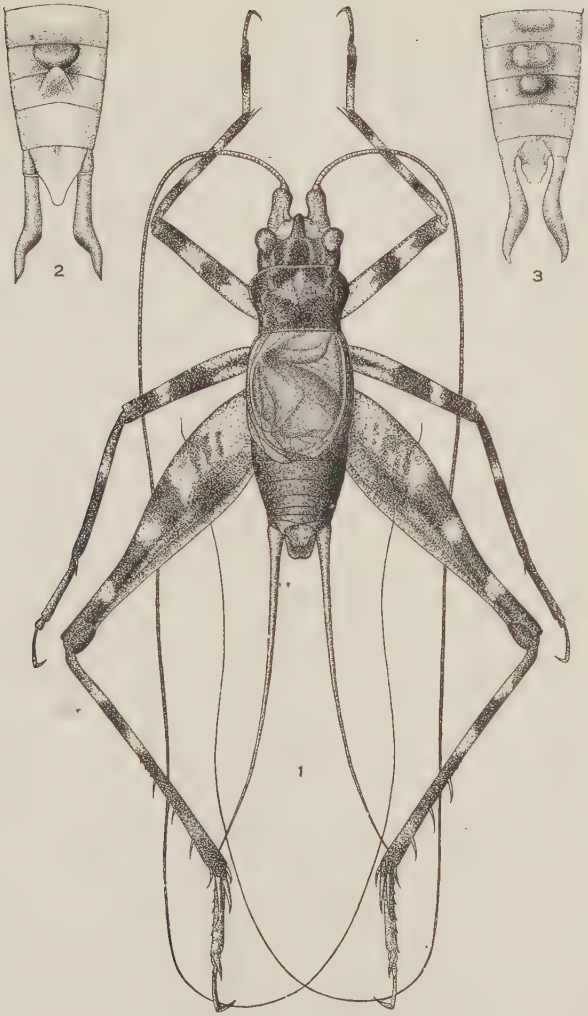
HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA

PLATE XV

Fig. 1.—*Aclodes maculatum* (Caudell). Dorsal view of male. Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. (X 2½.)

Fig. 2.—*Neoxabea trinodosa* new species. Dorsal view of distal portion of male abdomen and cerci. San Antonio, Cauca, Colombia. *Type.* (Much enlarged.)

Fig. 3.—*Neoxabea intricata* new species. Dorsal view of distal portion of male abdomen and cerci. Summit of Sierra San Lorenzo, Magdalena, Colombia. *Type.* (Much enlarged.)



HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA

PLATE XVI

Fig. 1.—*Aclodes nicuesa* new species. Outline of dorsal field of male dextral tegmen showing venation. (X 4.) Andagoya, Antioquia (Chocó), Colombia. (X 4.)

Fig. 2.—*Aclodes nicuesa* new species. Outline of lateral field of male sinistral tegmen showing venation. Andagoya, Antioquia, (Chocó), Colombia. (X 4.)

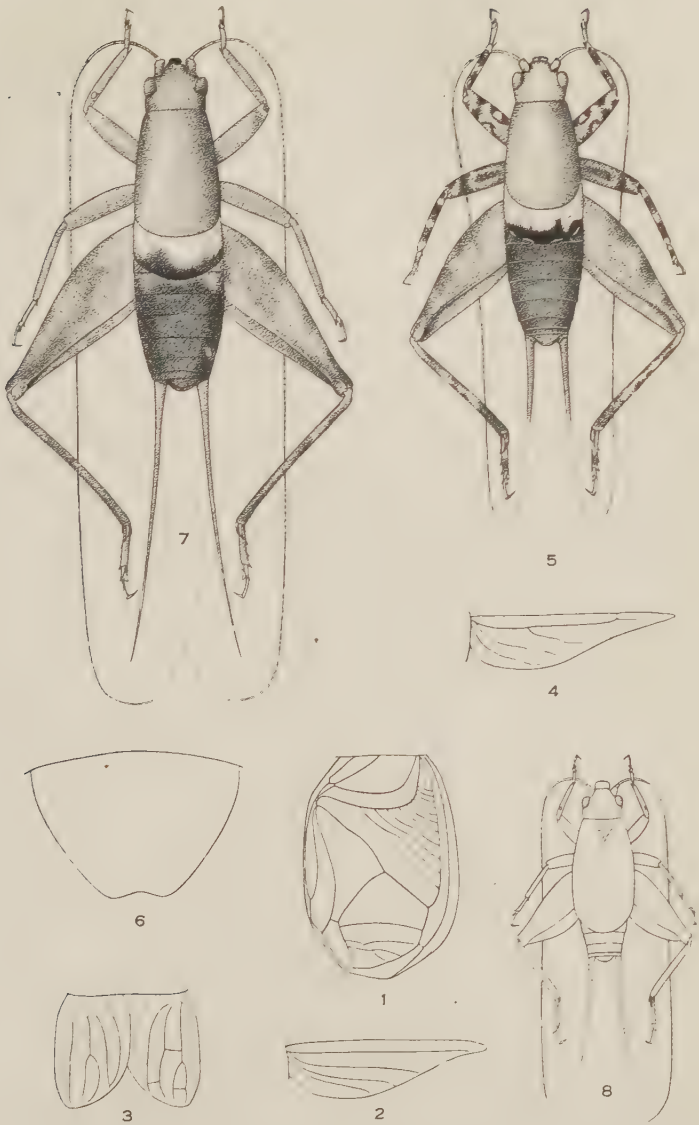
Fig. 3.—*Aclodes nicuesa* new species. Dorsal outline of female tegmina showing venation. Carrillo, Costa Rica. *Allotype.* (X 4.)

Fig. 4.—*Aclodes maculatum* (Caudell). Outline of lateral field of male sinistral tegmen showing venation. Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. (X 4.)

Fig. 5.—*Cycloptilum annulatum* new species. Dorsal view of male. Aracataca, Magdalena, Colombia. *Type.* (X 5.)

Fig. 6.—*Cycloptilum annulatum* new species. Ventral outline of female subgenital plate. Aracataca, Magdalena, Colombia. *Allotype.* (Much enlarged.)

Fig. 7.—*Cycloptilum scotops* new species. Dorsal view of male. Aracataca, Magdalena, Colombia. *Type.* (X 5.)



HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA

PLATE XVII

Fig. 1.—*Eugryllina acanthoptera* new species. Lateral outline of apex of female ovipositor. Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. *Paratype.* (Greatly enlarged.)

Fig. 2.—*Eugryllina acanthoptera* new species. Lateral outline of female ultimate palpal joint. Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. *Paratype.* (Greatly enlarged.)

Fig. 3.—*Eugryllina veraguae* new species. Lateral outline of female ultimate palpal joint. Porto Bello, Panama. *Type.* (Same scale as Fig. 2.)

Fig. 4.—*Anaxipha platyptera* new species. Lateral view of female ovipositor. Tabernilla, Canal Zone, Panama. (Much enlarged.)

Fig. 5.—*Paraphonus cophus* new species. Dorsal outline of male. Near summit of Sierra San Lorenzo, Magdalena, Colombia. *Type.* (X 2½.)

Fig. 6.—*Paraphonus cophus* new species. Lateral outline of female. Near summit of Sierra San Lorenzo, Magdalena, Colombia. *Allotype.* (X 2½.)

HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA

NEW OR LITTLE KNOWN NEOTROPICAL BLATTIDAE

(ORTHOPTERA)

NUMBER ONE

By James A. G. Rehn

In studying comprehensive collections of Blattidae from various parts of the Neotropical Region, I have on numerous occasions found it necessary to examine material belonging to other series not then under consideration. Usually these very essential digressions have been made imperative by efforts to locate previously described species, or to find additional data on new species present in the series under investigation at that time. The general results have been to bring to light numerous undescribed species, or even genera, which, to permit of necessary and logical discussion in the more comprehensive studies under way, require early publication in advance of the full analyses of the series of which they form parts. Occasionally the review of a genus or a group of species is made necessary by such contingencies, and in these cases the prompt publication of the results is advisable and desirable.

To meet the need for prompt publication of results of the type above described, it is my intention to bring out at intervals under the title of the present paper, contributions of this character on the Neotropical Blattidae.

The present number contains the descriptions of one new genus and eighteen new species, the re-defining of three previously-known species and revisions of the genus *Litopeltis* and the Elegans Group of the genus *Euphyllodromia,* with keys to the species in each of these cases.

The species here treated are: (Pseudomopinae) *Dendroblatta callizona* new species, British Guiana and Trinidad, *Ischnoptera*

hercules new species, British Guiana, *Euphyllodromia atropos* new species, Guiana, *E. elegans* (Shelford), *E. tupi* new species, Amazonia, *E. jugata* new species, Bolivia, *E. boliviensis* (Shelford), *E. nigrochlamys* new species, Amazonia, *Pseudomops praeclara* new species, Costa Rica, *P. zonata* new species, Peru; (Nyctiborinae) *Paratropes pensa* new species, Peru, *Nyctibora fictor* new species, Brazil; (Panchlorinae) *Schistopeltis lizeri* new species, Bolivia, *Phortioeca andeana* new species, Peru; (Perisphaerinae) *Litopeltis bispinosa* (Saussure), *L. musarum* new species, Costa Rica, *L. calverti* new species, Costa Rica, *L. votos* new species, Costa Rica, *L. biolleyi* (Saussure), *L. oreas* new species, Costa Rica, *L. deianira* new species, Costa Rica, *Cariacasia capucina* new genus and species, Costa Rica.

Pseudomopinae

Dendroblatta callizona[1] new species (Pl. XVIII, fig. 1, XIX, figs. 2-4.)

This beautiful species is related on one hand to *D. sobrina* Rehn[2], of Central America and Northern South America, and on the other to *D. insignis* Hebard[3], of Cayenne and Amazonian Peru. From *sobrina* it differs in its more symmetrical and differently proportioned male genitalia, particularly in the specialized parts of the tenth sternite (subgenital plate) and the markedly distinctive form of the tenth tergite (supra-anal plate), and in both sexes in the mesad constricted darker tegminal pattern and the heavier and more extensive dark areas of the pronotum, the female sex also having the tegmina shorter and broader than in *sobrina*. From *insignis* the present species can be separated at once by its much smaller size (the female sex alone being compared, as the male of *insignis* is unknown), the pronotal dark barring being longitudinal instead of transverse, the dark tegminal markings reaching the apices, instead of failing to reach the tips by a considerable distance as in *insignis*, and by the proportionately broader, less rostrate median portion of the tenth sternite (subgenital plate) of the female.

[1] From Καλλιζωνος, *beautifully girdled*, in allusion to the median constriction of the dark area of the tegmina.

[2] Trans. Amer. Entom. Soc. XLII, p. 232, pl. 14, figs. 11-14, (1916).

[3] Proc. Acad. Nat. Sci. Phila., LXXVIII, p. 146, pl. 12, fig. 10, (1926).

Type.—♂; Bartica, British Guiana. April 17, 1913. (H. S. Parish.) [Academy of Natural Sciences of Philadelphia, Type no. 5433.]

Size medium; form (when in repose) elongate lanceolate.

Head subpyriform in outline when seen in cephalic aspect, strongly narrowing ventrad, greatest width across eyes but slightly less than greatest depth of head; least interocular space but slightly wider than greatest width of proximal antennal joint: palpi elongate, slender; antepenultimate joint slightly longer than penultimate joint, infundibuliform; ultimate joint subequal in length to penultimate joint.

Pronotum transverse, broad elliptical, greatest length contained one and one-third times in greatest width of same; cephalic margin subtruncate, laterad narrowly rounding into the broadly arcuate lateral margins, caudal margin gently arcuate, passing regularly without indication of angle into the lateral marginal roundness; in transverse section the pronotum is weakly arcuate.

Tegmina surpassing apex of abdomen by less than pronotal length, lanceolate, greatest width contained three times in greatest length: costal margin arcuate proximad, thence nearly straight, briefly rounding to apex, which is more costal in position; sutural margin largely straight, in distal two-fifths broadly arcuate to apex: scapular field equal to half entire tegminal width; discoidal field with sectors weakly oblique, ten in number; anal field elongate pyriform, reaching to nearly two-fifths of tegminal length, axillary veins six in number. Wings reaching to but not surpassing tegminal apices when in repose; apex rather narrowly rounded; costal veins few, those arising from discoidal vein, with their rami, in the type numbering ten, simple, non-clavate; ulnar vein with four rami, of which the two distal are bifurcate; intercalated triangle small, narrow, elongate.

Abdomen with seventh tergite unspecialized. Supra-anal plate (tenth tergite) transverse, its free margin obliquely impressed laterad near the cercal bases, thence mesad broadly bilobate, with lateral portion of the lobes subvertical, median emargination marked but broadly obtuse-angulate; in transverse section the plate is subcucullate. Styles elongate fusiform, regularly tapering distad, acute, deplanate dorsad, rounded ventrad. Subgenital plate (tenth sternite) moderately transverse, from venter with margin arcuate, appreciably flattened mesodistad; seen in caudal aspect the margin of the plate is seen to be bent dorsad at right angles to the general ventral plane in three

parts, i. e. paired and nearly symmetrical broad subtrigonal lamellate extensions, which reach laterad to the cercal bases, and bear on their surface mesad, in marginal concavities, those structures which I am considering styles, and a median, erect, subpyramidical process, sharply bent dorsad, which in proximal half is regularly narrowing and distad is subequal and quadrate, this area in lateral profile weakly decurved: dextral style, vertical in position, broad, low, with a marked dorsal angle and its distal margin broad arcuate; sinistral style very similar to dextral, but with margin broadly rounded and non-angulate.

Cephalic femora having ventro-cephalic margin armed distad with two spines, the distal the longer, followed by a series of minute, closely placed, subpiliform spines, covering nearly half of femoral length, then a group of four heavy, spaced spines; ventro-caudal margin distad with three spaced spines. Caudal tarsi slender, with metatarsus comprising nearly three-fifths of tarsal length, and with second and third tarsal joints biseriately spinulose ventrad. Arolia present. Tarsal claws subequal, unspecialized.

Allotype.—♀; Caparo, Trinidad. August, 1913. (S. M. Klages.) [Hebard Collection.]

Differing from the description of the male sex in the following noteworthy characters.

Form shorter and more robust, pronotum larger, tegmina and wings hardly surpassing apex of abdomen.

Interocular width no greater, actually or relatively, than in male.

Pronotum of same type as in male but more transverse, with greatest width slightly caudad of middle and cephalic section of lateral margins longer in proportion and obliquely arcuate.

Tegmina but faintly surpassing apex of abdomen, of same general form as in male sex but proportionately broader and with apex broader, blunter and less appreciably costal, greatest tegminal width contained two and three-fifths times in greatest length of same; costal margin as a whole more regularly arcuate.

Supra-anal plate (tenth tergite) transverse, moderately trigonal produced, greatest length distinctly less than half proximal width, apex bilobate with median emargination acute-angulate, moderately deep, margin of lobate sections with spaced and radiating chaetae. Subgenital plate (tenth sternite) relatively broad, seen from venter with its distal margin arcuate with a weak median obtuse angulation; ventral surface of plate appreciably convex distad.

General pattern of dorsal surface of the contrasted and markedly bicolored type found in all the known species of the genus. Pale base color ranging from ochraceous-buff to pale zinc orange, darker in all individuals mesad on the pronotal disk. Dark pattern of dorsal surface prout's brown to mummy brown, distributed as here detailed. Pronotum with disk having a pair of broad lateral longitudinal dark areas, conforming laterad and cephalad to the discal outline, distinctly connected cephalad and caudad broadly passing into a transverse dark border of considerable width, which extends to slightly laterad of each of the caudo-lateral angles; lateral pale areas broad, completely separated cephalad by dark area reaching the cephalic margin, and caudad narrowed by the lateral extension of the dark caudal marginal bar; median pale area elongate, narrowing caudad, usually appreciably constricted cephalad of middle, occasionally (intensively colored female) with a median dark longitudinal pencilling which forks caudad. Tegmina with dark area covering virtually all of discoidal field and portions of anal and scapular fields, reaching to apex of tegmina, in fact covering all of the tegmina except the following pale areas; all of marginal field, nearly all of scapular field, with the dividing line here strongly sinuate mesad (slightly proximo-mesad in male), the pale area there extending costad to middle of tegmen and crossing discoidal vein, an irregular portion of anal field, limited costad by a dark triangular extension of the dark coloring, the pale area of the anal field broadest distad; tegminal dark area deeper in color proximad; in intensively colored individuals the costal veins in the pale area are lined to variable degrees with the dark color. Head with base color mars brown to prout's brown, with a generally indistinct pale facial pattern of buffy, when most pronounced consisting of a pair of dots in the interocellar region, a transverse V-shaped gorget between the antennae, a pair of broad reversed comma-shaped markings below this, a dot near each mandibular base and indefinite pale areas along the clypeal border; eyes cinnamon-brown to mummy brown; antennae prout's brown with proximal and second joints wholely or in large part pale. Limbs, including coxae, pale, the tibiae and proximal section of metatarsi generally clouded to some degree with prout's brown. Ventor of abdomen ochraceous-buff to ochraceous-tawny, broadly margined laterad with prout's brown. Dorsum of abdomen dresden brown, darkened laterad. Cerci pale, with prominent, narrow, dark proximal band on dorsal surface, prout's brown, most or all of ventral surface washed with same.

	Measurements (in millimeters)				
	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂					
Bartica, British Guiana, *type*	13.7	3.5	4.7	14	4.6
Caparo, Trinidad, *paratype*..	13.5	3.4	4.6	14.5	4.2
♀					
Caparo, Trinidad, *allotype*..	13.5	3.36	4.9	11	4.2
Caparo, Trinidad, *paratype*..	14.5	3.4	4.78	11	3.86
Trinidad, *paratype*.....	10.5	3.36	4.7	9.5	3.69

In addition to the type and allotype I have before me three males and three females from Caparo, Trinidad (June and August, 1913, (S. M. Klages)) and a female labelled merely "Trinidad" (Chipman), in the Academy and the Hebard Collections, and a female from Brassa, Trinidad (O. W. Barrett; on cacao), from the U. S. National Museum. All of these specimens may be considered paratypes.

There is some little size variation as the above measurements show, while the color pattern shows an intensive condition which has the dark areas deeper in tone, and the pale areas slightly more restricted or deeper in shade or weakly clouded. This condition has been mentioned above in the color description.

Callizona is a strikingly handsome species and its pattern is quite distinctive, except for possible superficial confusion with *D. insignis*, which is, however, nearly double the bulk of *callizona*.

Ischnoptera hercules new species (Pl. XIX, fig. 1.)

This species holds a position virtually intermediate between the Morio and Rufa Groups of the genus, having the general form and blackish coloration found in the first mentioned, and the very elongate narrow head and general type of male supra-anal plate (tenth tergite) of the second group. The membranous or subchitinous median area of the male supra-anal plate (tenth tergite) is smaller than in any species of the Morio Group known to me, and larger than in any of those of the Rufa Group with which I am acquainted. The great size of

this species will at once distinguish it from any of its allies, as in general bulk it might casually be mistaken for a *Periplaneta*.

Type.—♂; Kartabo, British Guiana. (William Beebe.) [Academy of Natural Sciences of Philadelphia, Type no. 5448.]

Size very large (for the genus) and with general form of a character which strongly suggests species of the genus *Periplaneta*.

Head pyriform in outline, greatest width across eyes contained one and one-seventh times in greatest depth of head (as 48 to 55), eyes not prominent: interspace between eyes as a whole narrow, ventrad regularly narrowing and there equal to but half depth of adjacent portion of eye, ventral width of interspace (.756 mm.) equal to nine-tenths the interspace between ocellar spots, which are large, vertical in position and sub-elliptical, truncate dorsad at contact with eye margin. Palpi subcompressed, with penultimate joint three-fourths the length of antepenultimate, infundibuliform, ultimate joint somewhat longer than antepenultimate and half again as long as penultimate.

Pronotum of the type usual in genus, in general shape ovate-subtrapezoidal, greatest length contained one and one-third times in greatest width of same; seen from dorsum cephalic margin is gently arcuate, appreciably rounding laterad into the gently arcuate caudad diverging cephalic sections of the lateral margins; point of greatest width slightly caudad of middle, at five-eighths of pronotal length; caudal sections of lateral margins arcuate convergent, passing by very broadly rounded angles into the subtruncate, very faintly obtuse-angulate caudal margin: surface of disk with a pair of appreciable, but not deeply or sharply marked, cephalad diverging impressions, caudad of which the disk is subdeplanate, while cephalad it is transversely arcuate; lateral areas of pronotum distinctly but roundly deflexed, cingulation of lateral margins pronounced.

Tegmina surpassing apex of abdomen by a distance nearly equal to pronotal length, in form elongate lanceolate, greatest width contained nearly three and a half times in length of tegmen: costal margin with the faint concavity in the proximal half of the scapular section which is characteristic of the species of the genus; sutural margin in large part nearly straight; in distal fourth both margins are convergent arcuate to the rather broadly rounded apex: marginal field of the generic type, relatively short, not equalling more than two-thirds

length of anal field, surface finely cribrose; scapular field in width not quite equal to one-third of entire tegmen; anal field elongate, attenuate pyriform, greatest width equal to one-third of length of field: costal veins twenty to twenty-one in number, some distad bifurcate; discoidal rami thirteen in number, the intercalated false nervures as distinct as the true rami; anal sulcus with its distal sixth sharply bent toward sutural margin, which it joins at an angle much less acute than the axis of most of the sulcus; axillary veins nine in number, the false intercalated nervures as prominent as the true axillaries.

Wings with costal veins numerous, proximad not clearly distinguished, non-clavate: medio-discoidal area relatively broad, nearly twice as wide as the medio-ulnar, regularly divided by cross nervures into subquadrate areolets fifteen or more in number; ulnar vein with three complete and six incomplete rami.

Eighth abdominal tergite short, with distal margin having a median broad V-shaped emargination; ninth abdominal tergite laterad as long as the eighth tergite, but with its distal margin broadly cut away and mesad truncate-emarginate, the same laterad obliquely divergent to the prominent lateral angles. Tenth abdominal tergite (supra-anal plate) of type usual in the related species, the lateral margins being sinuate-convergent to the narrowly rounded apex; subchitinous median area longitudinally subelliptical, subtruncate proximad, acute distad and narrowly reaching apex of tergite. Cerci relatively small, but little longer than median length of tenth tergite, depressed, gently tapering. Tenth abdominal sternite (subgenital plate) relatively short, of the type usual in the assemblage to which *hercules* belongs, asymmetrical, as seen from venter general form of distal margin is (reading dextro-sinistrad) first oblique subconvergent, then more sharply transverse concave to base of dextral style, which is on a rounded rectangulate production, at sinistral base of which is situated the sinistral style, thence sinistrad the margin is briefly arcuate; surface of sternite obliquely impressed proximo-laterad parallel to a portion of the distal margin and for nearly one-half width of tergite: styles unequal; dextral larger, styliform, incrassate, curved sinistrad; sinistral smaller, styliform, tapering, very slender, faintly decurved.

Cephalic femora with second (smaller) category of spines on ventro-cephalic margin very fine and short, in fact subpilose. Caudal metatarsi equal to very faintly more than half total tarsal length.

General color of head, pronotum and coxae pitch black, becoming pitch brown on the abdomen and limbs, tegmina dark claret brown proximad gradually paling distad. Head with

ocellar spots whitish; clypeus buffy, labrum and mandible tawny; eyes raw umber; antennae pitch black proximad, becoming orange rufous distad. Tegmina with coloring of distal section very weak and dilute. Wings clear hyaline, costal region largely auburn; discoidal and median veins and rami auburn, ulnar vein and these of radiate field claret brown. Limbs gradually paling from the dark coxae to the auburn tarsi.

Length of body, 26 mm.; greatest length of pronotum, 6.3; greatest width of pronotum, 8.3; length of tegman, 26; greatest width of tegmen, 7.5.

The type of this striking species is unique.

The Elegans Group of the Genus Euphyllodromia

In the past literature we find two species of this genus described by Shelford which are referable to an assemblage that for convenience I am terming the Elegans Group. These are *elegans* [4] and *boliviensis* [5], the former of which recently has been reported correctly by Hebard [6], while some years ago both were recorded by me in error from several Brazilian localities [7]. At the time of my previous work no material of true *elegans* or *boliviensis* was available for comparisons, and it now is evident that in the case of *elegans* I had before me a closely related but distinct undescribed species (here described as *E. tupi*), and in that of *boliviensis* a species of another group was involved. The latter erroneous determination is being corrected in another paper, and has no further connection with the present summary.

Being under the necessity of examining the characters and distribution of *E. elegans* in connection with an extensive faunistic study now under way, I assembled all the available material of it and a number of related species, which brought out the rather startling fact that six species belong to the assemblage, several of which have considerable areas of distribution, while the others may be localized, judging from the localities represented.

[4] *Pseudophyllodromia elegans* Shelford, Ann. and Mag. Nat. Hist., (7), XIX, p. 34, (1907). [♀; Maroni [River], French Guiana.]

[5] *Pseudophyllodromia boliviensis* Shelford, Deutsch, Entom. Zeitschr., 1909, p. 617, (1909). [♂, ♀; Mapiri, Bolivia.]

[6] Proc. Acad. Nat. Sci. Phila., LXXVIII, p. 188, (1926).

[7] Trans. Amer. Entom. Soc., XLII, p. 235, (1916).

A rather interesting feature in this group is the extent to which the proximal half of the antennae becomes appreciably incrassate and briefly plumose in certain species, and remains filiform and only sparsely haired in others. Apparently this should constitute an important group character, but the gradations found specifically, in other features, make such a division inadvisable.

Recognition of the species here treated rests largely on features of the color pattern of the pronotum and tegmina. In most cases I am strongly adverse to using such characters in the Orthoptera as specific criteria, and even in certain Blattidae their use is liable to lead to difficulty, if not error. Recession and intensification of pattern produce very different appearances, and full allowance must be made for this type of fluctuation, even in those cases where intensification does not bring out elements of the pattern which are hardly or not at all evident in the recessive condition. However, in the species now before me there is present a set of color combinations which are also noted in other species and groups of species of this genus, and these apparently are fixed, at least to the degree that the individual types are quite recognizable. The chief types are as follows:

(1) *Pronotum.* In the dark disk a pair of closely placed median pale dashes may (all species of the group except *nigrochlamys*) or may not (*nigrochlamys*) be indicated. Laterocephalic portions of the disk may be concolorous with remainder of disk, i. e. blackish, and co-extensive with disk, or a margining reddish or buffy area may be indicated, thus narrowing the cephalic section of the dark disk. In *E. tupi* a fine dark pencilling follows the outline of the discal area and thus encloses subreniform buffy areas.

(2) *Tegmina.* The pale areas may be limited to the marginal field and costal section of scapular field, the remainder solidly blackish (*nigrochlamys*), or distad the vicinity of the humeral trunk alone may be darkened; an arcuate hyaline bow is indicated proximad in the discoidal field and bordering the anal sulcus on the costal side in all the species except *nigrochlamys*, while the anal field is solidly darkened (*elegans*, *jugata*

and *nigrochlamys*) or has a medio-longitudinal hyaline or subhyaline area (*atropos, tupi* and *boliviensis*). In those cases where the tegminal anal field is in part hyaline or subhyaline the clear area is crossed by the dark pencillings of the axillary veins.

While there is some little tonal fluctuation in these patterns I have seen no material directly connecting them, and, as in *Paratropes*, *Epilampra*, *Eustegasta*, *Cariblatta* and a number of other genera of Blattidae, we must utilize these features, supported as they are in some cases by structural characters, and also seen to be without geographic significance in others. It is hardly necessary to state there is no sexual correlation in these patterns.

The following key will serve to distinguish the species which are here treated.

A. Antennae not incrassate, at most but sparsely pilose proximad.

B. Anal field of tegmina solidly infumate and contrasted with the bordering hyaline proximal circa-ulnar section of discoidal field. (Pronotal form as in *P. atropos,* see below.) (French Guiana.) ..... *elegans* (Shelford)

BB. Anal field of tegmina mesad hyaline crossed by the pencilling of the axillary veins, this area and the hyaline proximal circa-ulnar section of discoidal field throwing the intervening infumate belt into prominence, producing in the tegmina as a whole a bilineate appearance.

C. Interspace between eyes at most but slightly less than distance between antennal scrobes. Pronotum less strongly transverse elliptical, caudal margin of same not at all truncate, as a whole distinctly broad obtuse-angulate. Size smaller. (British and Dutch Guiana.)
atropos new species

CC. Interspace between eyes very distinctly less than distance between antennal scrobes. Pronotum more strongly transverse elliptical, proportionately shorter, caudal margin as a whole subtruncate, weakly subarcuate mesad. Size larger. (Amazonian Brazil to Colombia.)
tupi new species

AA. Antennae distinctly incrassate proximad, there briefly but thickly pilose.

B. Pronotal dark discal pattern with paired median pale markings. Tegmina never with anal and discoidal fields solidly dark and of the tone of pronotal disk, vividly contrasted with costal margin of tegmina.

C. Anal area of tegmina without marked contrasted median hyaline area. Palpi distad white. Size larger. (Eastern Bolivia.) ..... *jugata* new species

CC. Anal area of tegmina with a marked and contrasted median hyaline area, which with hyaline proximal circaulnar section of discoidal field gives to that portion of the tegmina a bilineate appearance. Palpi with two distal joints at least in part blackish brown. Size smaller. (Central and western Amazonia.) . . *boliviensis* (Shelford)

BB. Pronotal dark discal pattern without paired median pale markings, a short medio-cephalic buffy incision and a mediocaudal subobsolete buffy or whitish spot alone breaking the solid marking. Tegmina with anal and discoidal fields solidly dark, marginal field and costal portion of scapular field contrastingly buffy. (Eastern Peru.)
nigrochlamys new species

Euphyllodromia elegans (Shelford) (Pl. XVIII, fig. 3.)

1907. *Pseudophyllodromia elegans* Shelford, Ann. and Mag. Nat. Hist., (7), XIX, p. 34. [♀; Maroni [River], French Guiana.]

1926. *Euphyllodromia elegans* Hebard, Proc. Acad. Nat. Sci. Phila., LXXVIII, p. 188. (In part not of Shelford.) [French Guianan records only.]

The material reported by Hebard in 1926 as *elegans* is composite, only that from the various French Guianan localities being true *elegans*. The other components are here assigned in their proper associations.

Elegans is a species with a broad interocular space, relatively filiform and non-incrassate antennae, which are sparsely pilose and have no pale annulus distad. The pronotal form and pattern are essentially as in *E. atropos*, but the anal area of the tegmina is solidly dark and the delimitation of the dark humeral marking of the tegmina on the sutural side is more sharply and regularly indicated.

I have before me nine specimens in the collection of the Academy and the Hebard Collection, from the French Guianan series reported by Hebard in 1926.

Euphyllodromia atropos new species (Pl. XVIII, fig. 4, XIX, fig. 13.)

1907. *Euphyllodromia elegans* Hebard, Proc. Acad. Nat. Sci. Phila., LXXVIII, p. 188. (In part.) [Mallali, British Guiana record only.]

Very closely related to *E. elegans,* of which at first examination it appears to be merely a recessively colored individual. However, the tegminal pattern is very similar to that of *E. tupi,* here described, which differs from *atropos* in structural features. While the anal field of the tegmina is solidly fuscous in *elegans,* the same area in *atropos* has a clear hyaline median area, crossed by two dark pencilled axillary veins. While the general darkening of the neighborhood of the humeral trunk of the tegmina distad of the point of divergence of the discoidal and median veins is relatively heavy in *atropos,* this infuscation is less extensive in the discoidal field and penetrates less markedly toward the apex of the anal field than in *elegans.* The two forms, i. e. *atropos* and *elegans,* can be separated very readily by the unaided eye—in fact more readily than *atropos* can be distinguished from *E. tupi,* the diagnostic features of which are structural.

Type.—♀ ; Mallali, British Guiana. March 11, 1913. (H. S. Parish.) [Academy of Natural Sciences of Philadelphia, Type no. 5457.]

Size, structure and form as in *E. elegans.*

Allotype—♂ ; Zanderij Island, Boven Pará District, Surinam. April 19, 1927. (Cornell Univ. Exped.) [Academy of Natural Sciences of Philadelphia.]

Agreeing with the female sex of *E. elegans* in size, structure and general form.

General coloration of pronotum and tegmina in both sexes translucent weak antimony yellow, with an overlaid pattern of pitch brown distributed as follows: disk of the pronotum with a symmetrical figure, narrowing caudad, and formed as in the accompanying figure (Plate XVIII, fig 4), enclosing a median tongue of warm buff, which extends caudad to near the center of the dark pattern, a pair of longitudinally disposed elongate elliptical pale spots situated on the transverse axis of the pronotum, and a caudal transverse smaller elliptical spot; cephalolaterad the structural margins of the dark disk are emarginate as far as color is concerned to an appreciable degree, these areas, one on each side, being dark ochraceous-orange: tegmina over-

laid with mummy brown in the region of the humeral trunk, a broad cloud extending thence to the apex of the tegmina involving at least internal half and a regularly increasing amount distad of the scapular field, as well as the discoidal space between the discoidal vein and the first ramus of the median vein, the area between the anal vein and the nearest axillary vein, a considerable area along the sutural margin of the anal field, widening toward apex of that field, and a narrow border along the sutural margin of the discoidal field, the distal border of the whole tegmen more weakly clouded with the same color; the hyaline areas of the tegmina are tinted with the general color, except that the costal section of the scapular field is nearly clear hyaline. Head, coxae and limbs ochraceous-buff; occiput and interocular area ventrad to a nearly straight line between the ocellar spots, deep zinc orange; eyes dresden brown, slightly speckled with mummy brown; antennae with two proximal joints of the pale color of the face, remainder pitch brown; palpi with ultimate joint and distal portion of penultimate joint pitch brown. Wings with veins pencilled with pitch brown, marginal edging to region of costal veins warm buff, this area bordered internally by a relatively solid area of pitch brown, which is more weakly continued proximad along the costal margin of the wing, and also clouds the apex of the anterior field, the whole tegmen very weakly washed with the same tone, slightly stronger toward the periphery of the radiate field. Meso- and metanota and dorsal surface of abdomen pitch brown, the mesonotum caudad with a median triangle of dull warm buff and a pair of spots of the same adjacent to the tegminal bases; metanotum meso-caudad with a reversed spectacle-like pale marking; dorsum of abdomen with a median group of three subtrigonal spots warm buff, one each on the second, third and fourth tergites, the triangles pointed proximad; lateral margins from third segment to cercal bases rather broadly margined with cinnamon-rufous, more buffy proximad: venter of abdomen very dull zinc orange in the allotype and paratypic female, most or all of tergites to ninth narrowly edged laterad and largely so caudad with milk white, tenth sternite (subgenital plate) in female meso-distad with a triangle of pitch brown, the margins of same ventrad of cerci indistinctly bordered with warm buff; cerci very dull zinc orange, in female the dorsum has the proximal half pitch brown.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, Zanderij Island, Surinam, *allotype*	9	2.52	3.52	9.5	2.52
♀, Zanderij Island, Surinam, *paratype*	8.1	2.56	3.61	9.5	2.43
♀, Mallali, British Guiana, *type*	10	2.6	3.61	9.7	2.77

In addition to the type and allotype I have before me a paratypic female bearing the same data as the type, except that it was taken April 25, 1927.

Euphyllodromia tupi[8] new species (Pl. XVIII, fig. 5, XIX, fig. 14.)

1916. *Pseudophyllodromia elegans* Rehn, Trans. Amer. Entom. Soc., XLII, p. 235. (Not of Shelford.) [♂; Pará, Brazil.]

1921. *Euphyllodromia elegans* Hebard, Trans. Amer. Entom. Soc., XLVII, p. 129. (Not of Shelford.) [♂; Cauca, Colombia.]

In 1916 Hebard[9] pointed out the more salient features of this species, which he then recognized as undescribed. It is a member of that section of the group having the antennae of a simple type, although representing a slight trend toward the incrassate, heavily plumose condition. The pronotal pattern is distinctive and the tegminal one has much resemblance to that of *atropos*, but the width of the interocular space at once will distinguish *tupi* from either *elegans* or *atropos*.

Type—♂; Pará, State of Pará, Brazil. (C. F. Baker.) [Academy of Natural Sciences of Philadelphia, Type no. 5458.]

Size slightly larger than in *E. atropos* and *elegans;* form similar.

Head in outline cordiform as seen in facial aspect, strongly narrowing ventrad, greatest width across eyes one and one-ninth times greatest depth of head (as 30 to 27), the eyes laterad distinctly prominent though rounded: occipital line straight as seen in cephalic view, the eyes dorsad in contour hardly marked off from the occiput: interocular width at occiput rela-

[8] From the dominant Tupi family of Amazonian aborigines.

[9] Proc. Acad. Nat. Sci. Phila., LXXVIII, p. 188, (1926.)

tively narrow, but slightly more than half of the distance between ocellar spots (as 6½ to 11) and but two-thirds that between inner margins of antennal scrobes (as 6½ to 10); internal eye margins at occiput straight and slightly divergent caudad: face subdeplanate. Antennae very distinctly surpassing the body in length, simple, filiform, moderately pilose, not at all plumose. Palpi slender, elongate, antepenultimate and penultimate joints nearly equal in length, the latter slightly the longer (as 9 to 8); ultimate joint shorter (7.5 in same ratio), subsecuriform, compressed.

Pronotum transverse elliptical, greatest length contained slightly more than one and three-fifths times in the greatest width (as 29 to 47), which is very faintly caudad of the median transverse axis: cephalic margin broadly low arcuate, laterad passing by a faint but still evident subangulation, immediately dorsad of the eyes, into the strongly arcuate lateral margins, which in detail are faintly suboblique cephalad and more markedly convex caudad, latero-caudal angulations much like those latero-cephalad, being apparent dorsad of the tegminal insertions, the caudal margin between these points with a very broad but low median production, far less marked, however, than the similar development found in *E. atropos* and *elegans*, the margin on each side of the angulation and between it and the passage into the lateral margins very faintly sinuato-concave: surface of pronotum with straight oblique, cephalad diverging sulci caudo-laterad on the disk, those areas of the pronotum dorsad of the tegminal bases weakly inflated, those portions cephalo-laterad weakly declivent.

Tegmina surpassing the apex of the abdomen by a distance nearly equal to the greatest width of the pronotum, general shape and character of the tegmina as characteristic of the genus, width at proximal third and at distal third subequal, contained nearly three and seven-tenths times in the greatest length of the same; costal margin straight mesad, moderately arcuate proximad, narrowly arcuate distad to the apex, which is slightly costal in position, rather narrowly rounded and passing by an oblique arcuation into the straight distal section of the sutural margin, anal section of the same margin subarcuate: scapular field broad, mesad subequal in width to the adjacent section of the discoidal field, distad the latter is faintly broader; anal field elongate subpyriform: costal veins twelve to thirteen in number, not considering the bifurcations; discoidal vein appreciably sigmoid; discoidal rami three, not including the intercalated nervures between the discoidal vein and the first ramus of the median vein, between the rami of the latter, and the sec-

ond ramus of the median and the ulnar vein; anal sulcus straight oblique in its distal three-fifths except for the brief distal bent section, where it turns to meet the sutural margin; axillary veins six in number, those toward sutural margin crowded, while those toward the anal sulcus are well spaced. Wings with costal margin straight in the region of the costal veins, slightly oblique thence proximad, distad and at apex reproducing the outline of the same section of the tegmina; costal veins fourteen in number, counting rami, the proximal five appreciably but not strongly clavate; ulnar vein triramose.

Abdomen with the tenth tergite (supra-anal plate) narrow, strongly transverse, distal margin very slightly obtuse-angulate produced. Cerci fusiform, acute distad, distinctly deplanate dorsad. Tenth sternite (subgenital plate) of the subtrigonal type usual in the group; styles small, subcompressed lamellae, trigonal in lateral outline, closely placed, in normal position set vertically and touching at their apices.

Caudal tarsi with metatarsus comprising eleven-seventeenths of the whole tarsal length (as 22 to 34).

Color pattern strongly suggesting that of *E. atropos*, having in certain respects essentially the same distribution of much of the pattern with modifications in extent and details. General pale color translucent weak antimony yellow, with the overlaid dark pattern pitch brown. Head with occiput zinc orange to dresden brown (allotype), the latter possibly due to dessication; face below an arcuate line margining the occipital color, and situated slightly dorsad of the ocellar spots, warm buff to antimony yellow; eyes tawny to dresden brown, often in large part blotched or speckled with fuscous; antennae with two proximal joints wholly or in large part of the pale face color, the antennae distad of these pitch brown; palpi cream white, the ultimate joint occasionally narrowly tipped with pitch brown and the antepenultimate sometimes lined laterad with the same. Pronotum with dark disk pattern narrower than in *atropos* and *elegans*, of the form shown in Plate XVIII, figure 5, having a median pale tongue dividing it for some distance cephalad, a pair of median longitudinally disposed elliptical pale spots and a meso-caudad pale spot of variable outline, which is close to the paired spots and rarely nearly confluent; latero-cephalad considerably sized areas of more opaque pale color break into the dark disk outline, and these are more or less distinctly outlined on the structural border of the disk with a pencilling of pitch brown. Tegmina with the dark areas basically as in *atropos*, but modified as follows: humeral trunk sometimes much darker than the general wash of the dark areas (Peruvian speci-

mens); interspace between discoidal vein and first ramus of median vein variable in the degree to which it is involved in the dark infuscation, also the degree to which the greater portion of the distal two-thirds of the discoidal field is subhyaline; all veins and intercalated nervures pencilled in dark, area at base of interspace between discoidal vein and first ramus of median vein, also that at base between rami of median vein as clear hyaline as that section between humeral trunk and anal vein; median hyaline area of anal field distinctly barred by the infuscate axillary veins crossing it. Wings as in *E. atropos*. Abdomen above and below dull ochraceous orange, occasionally (one female from El Campamiento) much suffused dorsad and laterad on venter intermarginally with pitch brown; occasionally the sternites are narrowly edged laterad and distad with whitish. Cerci of the general abdominal color, on ventral surface beaded to a variable degree with pitch brown, in the intensive El Campamiento female the cerci are almost entirely dark, the apex of the tenth sternite (subgenital plate) in this has a subcircular spot of dark at median incision, the disto-lateral margins of same tergite dull creamy white.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, Pará, Brazil, *type*	9	2.43	3.94	10.2	2.77
♂, El Campamiento, Peru, *paratype*	9.7	2.52	4.03	11.2	2.91
♀, El Campamiento, Peru, *paratype*	9.2	2.52	3.86	11.4	2.85

In addition to the type I now have before me five specimens which I am considering paratypes. These are:

Pará, State of Pará, Brazil. July 5, 1919. (H. S. Parish.) One male. [A. N. S. P.]

Yurimaguas, Huallaga River, Peru. March 29, 1920. (H. S. Parish.) One male. [Hebard Cln.]

El Campamiento, Colonia Perené, Peru. June 21-30, 1920. (Cornell Univ. Exped.) Two males, one female. [Cornell Univ. and A. N. S. P.]

These specimens fully agree with the type and exhibit no noteworthy structural differences. All the specimens from Peru have the tegminal pattern more sharply contrasted clear hyaline

and infuscate than in the Pará individuals, which latter have those areas which are clear hyaline in Peruvian material, weakly washed with pale ochraceous. This difference seems to be individual, but may prove to be geographic when larger series are available. A single male specimen from Cauca, Colombia, in the collection of the Academy of Natural Sciences is referred to this species [10]. It lacks most of the limbs and the apex of the abdomen has been subject to pressure, so that its features cannot be compared with those of the other specimens. The occipital interspace and the pronotal form and pattern are essentially as in the type. The tegminal pattern is weaker than in the other specimens, even less sharply contrasted than in the Pará individuals. There exists some possibility the locality may be incorrect, and that the individual may have been secured at some point in the Amazonian drainage system. However, I prefer merely to call attention to its peculiarities and to await further material before making any definite deductions. Without it the other specimens demonstrate that *P. tupi* has the greatest known area of distribution of any species of the group, i. e. from the Perené territory of the Huallaga River to the mouth of the Amazon (Pará).

Euphyllodromia jugata new species (Pl. XVIII, fig. 6.)

A form with the anal and discoidal fields of the tegmina solidly rufescent, and with the antennae incrassate proximad and plumose. It is very closely allied to *E. boliviensis* and bears much the same relation to that species as *elegans* does to *atropos*, while its pronotal pattern is of a type which connects that seen in the species with non-incrassate and sparsely pilose or non-pilose antennae, with the forms having these appendages incrassate and strongly pilose. In *jugata* the palpi are unmarked with fuscous, while in *boliviensis* distad there is a decided though variable degree of infuscation; also in *jugata* the cerci are unicolorous, while in *boliviensis* at least proximad there is distinct infuscation.

Type.—♂; Provincia Sara, eastern Bolivia. February 5-20, 1922. (José Steinbach.) [Hebard Collection, Type no. 1124.]

[10] Hebard recorded this specimen as *P. elegans* (Trans. Amer. Entom. Soc., XLVII, p. 129, (1921)).

Allotype.—♀; same data as type, but without month or day, and with an altitude of 400 meters. [Hebard Collection.]

Size appreciably though not greatly larger than *E. boliviensis;* form and structure as in the latter species.

The color description here given is based comparatively on the full analysis of the color of *E. tupi*, the features of difference being as here stated. Pronotal dark disk pitch brown, the medio-caudal pale spot quite small, latero-cephalic pale intrusions of the disk as shown in Plate XVIII, figure 6, less extensive than in *E. tupi*, and not outlined by dark pencillings latero-cephalad; more lateral portions of pronotum more transparent and less opaque than those sections nearer the dark disk. Head with occipital area to ventral line between ocellar spots orange rufous, this separated by a band of antimony yellow from the clay color of face, the band ventrad passing into the face color; eyes buckthorn brown indefinitely clouded with mummy brown; antennae incomplete, as far as preserved pitch brown, a few proximal joints occasionally of the paler face color dorsad; palpi cream white, antepenultimate and penultimate joints weakly lined in pitch brown. Tegmina almost entirely tawny to ochraceous-tawny, slightly weakened before the apex in the discoidal field, the marginal field and the costal portion of the scapular field paled to translucent very weak yellow ocher; veins and intercalated nervures pencilled in pitch brown to prout's brown. Wings with pale edging to region of the costal veins and adjacent infuscation as in *E. atropos* and *tupi*. General color of abdomen dull zinc orange, the dorsum of abdomen much infuscate with pitch brown in a pattern consisting largely of narrow lateral and distal marginings to the tergites and intermarginal longitudinal dark clouds, a considerable area of the preapical section rather solidly infuscate; venter of abdomen with the sternites narrowly edged laterad and distad with whitish, free margin of tenth sternite (subgenital plate) of male edged with ochraceous, styles similarly colored; tenth sternite (subgenital plate) of female medio-longitudinally pitch brown, this expanding proximad, and distad to the incision with a medio-longitudinal pale line, medio-distal margins of plate from ventrad of cercal bases to median fissure bordered with ochraceous; cerci of the abdominal color, narrowly edged laterad with dresden brown. Limbs clay color with a more ochraceous tinge, extensor, and more rarely flexor, surfaces sometimes clouded with prout's brown; tibial spines pale tawny.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, *type*	11.1	2.85	3.78	10	2.91
♀, *allotype*	9.4	2.85	3.94	—[11]	2.77

The type and the allotype are the only specimens of this species I have seen. The allotype has the tegmina considerably damaged and lacks all of the median and caudal limbs. However, it definitely supports the distinctive character of the color pattern and tone features found in the type, and is added evidence that *jugata* is a species of larger size than *boliviensis*.

Euphyllodromia boliviensis (Shelford) (Pl. XVIII, fig. 7.)

1909. *Pseudophyllodromia boliviensis* Shelford, Deutsch. Entom. Zeitschr., 1909, p. 617. [♂, ♀; Mapiri, Bolivia.]

1926. *Euphyllodromia elegans* Hebard, Proc. Acad. Nat. Sci. Phila., LXXVIII, p. 188. (In part not of Shelford.) [Records from Teffe, Brazil, and Yurimaguas, Peru.]

Boliviensis is a species of wide distribution and with a readily recognized combination of characters. It is the only species of the group with plumose and incrassate antennae having contrasted hyaline and infumate areas of the discoidal and anal fields of the tegmina. In size it averages smaller than *tupi* or *jugata*, and even then *elegans*, while the pronotal pattern is constant except for a very slight amount of variation in the firmness of the latero-cephalic portions of the margin of the dark area, and also in the presence or absence of at best a weak medio-caudal whitish spot. The pale antennal annulus is always present.

I have before me a series of thirteen specimens, five males and eight females as follows:

Rio Purús, State of Amazonas, Brazil. January. (Roman.) One male, one female. [Stockholm Museum.]

Teffe, State of Amazonas, Brazil. December 2 and 8, 1919. (H. S. Parish.) One male, one female. [Hebard Colln.]

Yurimaguas, Huallaga River, Loreto Province, Peru. April 5, 1920. (H. S. Parish.) One male. [Hebard Colln.]

[11] The apices of the tegmina are too badly damaged to permit of an accurate measurement of the tegminal length.

Puerto Bermudez, Rio Pichis, Junin Province, Peru. July 12-19, 1920. (Cornell Univ. Exped.) One female. [Cornell Univ.]

Rio Aguachini, Camino del Pichis, Junin Province, Peru. July 30, 1920. (Cornell Univ. Exped.) One male. [Cornell Univ.]

Azupizú to Miriantiriani, Camino del Pichis, Junin Province, Peru. July 9, 1920. (Cornell Univ. Exped.) One male, five females. [Cornell Univ. and A. N. S. P.]

From these localities it is evident the species is of wide distribution in central Amazonia and the region of the upper Amazon tributaries.

In size the above series is relatively uniform. Two representative pairs measure (in millimeters) as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, Teffe, Brazil	9.2	2.35	3.27	9.4	2.52
♀, Azupizú to Miriantiriani, Peru	8.7	2.52	3.46	10	2.52
♀, Teffe, Brazil	8.6	2.35	3.31	8.8	2.35
♂, Azupizú to Miriantiriani, Peru	8.4	2.43	3.36	9	2.43

Euphyllodromia nigrochlamys[12] new species (Pl. XVIII, fig. 8.)

A distinctively marked species, nearly related to and much the same size as *E. bolivensis*, but having the pronotal discal pattern solidly blackish except for a short medio-longitudinal pale division cephalad and a subobsolete pale medio-caudal spot, while the tegmina, aside from a narrow pale costal margin embracing the marginal and costal half of the scapular fields, are solidly dark.

Type.—♂; Iquitos, Loreto Province, Peru. February 20, 1920. (H. S. Parish.) [Academy of Natural Sciences of Philadelphia, Type no. 5459.]

Size and form as in *E. boliviensis*.

Head in facial aspect triangular in outline, rounded laterad about the eyes, greatest width across latter but faintly greater

[12] In allusion to the blackish mantling of the dorsal surface.

than depth of head (as 28.5 to 27): occipital line virtually straight transverse as seen in facial aspect, the occipital interspace broad, subequal to interspace between internal margins of antennal scrobes and equal to three-fourths that between ocellar spots (as 9 to 12); face appreciably deplanate. Antennae distinctly surpassing the body in length, beyond the second joint appreciably though not markedly incrassate, becoming filiform distad, rather thickly although not heavily pilose in the incrassate section, the pilosity sparse distad. Palpi shorter and less slender than in *E. tupi,* but proportions similar.

Pronotum of the type found in *boliviensis,* roughly describable as sub-octagonal elliptical, the greatest length contained slightly more than one and one-third times in the greatest width (as 30 to 41): cephalic margin regularly and broadly low arcuate, passing to the lateral margins by distinct though very broadly obtuse angles dorsad of the eye outline; lateral margins oblique subarcuate, diverging caudad to the broadly rounded points of greatest width, which are faintly caudad of the transverse axis, caudo-lateral margins oblique nearly straight convergent to the caudo-lateral angles, which are broadly obtuse but quite evident, and placed dorsad of the humeral trunk of the tegmina when in repose position; caudal margin broadly obtuse angulate, appreciably but not markedly produced mesad, the immediate angle broadly rounded: surface of pronotum with the cephalad diverging sulci quite marked; lateral sections of pronotum moderately declivent.

Tegmina surpassing the apex of the abdomen by somewhat less than the pronotal length, lanceolate, greatest width, which is at proximal two-fifths, contained four and one-tenth times in greatest tegminal length: margins as usual in the genus, the costal mesad with the faintest suggestion of concavity: marginal field as in *boliviensis,* slightly broader than in *tupi;* scapular field broad, mesad but slightly narrower than the adjacent portion of the discoidal field; anal field elongate pyriform: costal veins, including rami, eighteen to nineteen in number; discoidal sectors three to four in number, excluding intercalated nervures, the proximal ramus of the median vein being simple or bifurcate; anal sulcus straight oblique in distal half, except for the sharp curvature to meet the sutural margin, which is joined at a right angle; axillary veins six in number, those suturad more closely assembled than those costad in position. Wings as described for *E. tupi.*

Abdomen with tergites distad to and including seventh laterad with the usual oblique intermarginal carinulae; tenth ter-

gite (supra-anal plate) short, strongly transverse, its distal margin rounded obtuse-angulate produced. Tenth sternite (subgenital plate) relatively short, moderately transverse, somewhat asymmetrical, the infra-cercal section of the sinistral side of the margin more distinctly obtuse-angulate than the dextral, the more distal portions of margin obliquely converging to styles, narrow inter-stylar portion minutely acute produced; styles simple, placed mesad, narrowly separated at bases, converging at apices when in normal position, in form moderately compressed lamellae, in profile short, sharply narrowing, slightly acute-angulate at apex. Cerci fusiform, acutely tapering in distal half, projecting distad of subgenital plate by about the length of the same plate, deplanate dorsad.

Caudal tarsi with metatarsus comprising about nine-sixteenths of the entire tarsal length, very appreciably longer than the remaining tarsal joints (as 19 to 14).

Allotype.— ♀ ; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the above description of the type in the following sexual features.

Pronotum faintly longer and narrower than in the male (as 30.5 to 40).

Tegmina slightly shorter and broader than in the male, in the allotype the greatest width contained three and four-fifths times in the greatest tegminal length, the tegmina surpassing the shorter, broader abdomen by approximately the pronotal length; costal veins fewer, sixteen in number including rami.

Abdomen shorter and broader. Tenth abdominal tergite (supra-anal plate) short, strongly transverse, its distal margin mesad obtuse-angulate emarginate, the sections of the margin laterad of the emargination subsigmoid, the paired arcuate lobations produced on each side of the median excision being proportionately large. Tenth sternite (subgenital plate) relatively large, appreciably arcuate produced meso-distad, with a median incision for nearly a third the median length of the sternite, the incision narrowly opened in a V-emargination distad, the area of the tergite traversed by the incision distinctly reflexed dorsad, the same section subconcave in profile.

General color of pronotal disk and entire tegmina solidly pitch brown, appearing black except by transmitted light, except for the pale ochraceous-buff marginal field and a continuation of the same color as a costal border to the scapular field involving the outer two-fifths of that area; broad lateral areas of pronotum clear hyaline, weakly clouded with pale ochraceous-

buff near the dark disk; pronotal disk with the usual medio-longitudinal pale ochraceous-buff tongue dividing the disk cephalad for about two-fifths of its length. Head as described for *E. jugata* but pale band between occipital and face colors broader, particularly mesad; antennae slightly distad of middle with a pale ochraceous-buff band equal in length to remainder of antenna, the distal extremity prout's brown; palpi with ultimate and penultimate articles pitch brown, the latter narrowly lined dorsad with pale ochraceous-buff. Wings much as in *E. jugata*, but as a whole more heavily infumate. Venter of abdomen and limbs between clay color and yellow ocher in tone, the abdomen faintly more ochraceous-orange in certain individuals; dorsal surface of abdomen mummy brown, very finely edged laterad with ochraceous-buff; medio-longitudinally tergites second to seventh have a series of subtriangular light ochraceous-buff markings, much as in *E. jugata*. Abdominal sternites proximad and intermarginally laterad clouded with mummy brown, a fine lateral edging of sternites and free margin of tenth sternite ochraceous-buff. Tibiae occasionally clouded on extensor surface with prout's brown.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, *type*	10.4	2.52	3.44	9.7	2.35
♂, *paratype*	8.2	2.35	3.52	9.4	2.43
♀, *allotype*	8.6	2.56	3.36	9.2	2.39
♀, *paratype*	9.4	2.60	3.36	9	2.52

In addition to the type and allotype I have before me six specimens, which I am considering paratypes, all taken at Iquitos, Peru, as follows:

February 20, 1920. (H. S. Parish.) One male, one female. [A. N. S. P.]

May 3-11, 1920. (H. S. Parish.) Two males, one female. [Hebard Colln.]

July 28, 1920. (Cornell Univ. Exped.) One male. [Cornell Univ.]

The measurements given above show there is some variation in the size, but more distinctly in the proportions of the pronotum and the tegmina in each sex. While these fluctations are

not great enough to cause any difficulty in the interpretation of the species, or to modify the form of the parts involved, they are sufficient to show an appreciable amount of instability in these ratios. Similar variations also are found in the related *E. boliviensis*, as the measurements given under that species demonstrate. The present series shows no noteworthy differences in structure or coloration not covered in the description. The pattern of this species is so distinctive that its recognition by the coloration alone is exceedingly easy.

Pseudomops praeclara new species (Pl. XIX, figs. 8 9, XX, figs. 3-4.)

One of the largest species of the genus, related to *P. intercepta* Burmeister, from Mexico, but readily separable by its much greater size, more heavily plumose antennae, more longitudinal pronotum, more elongate tegmina, acutely fusiform styles, black head, pronotal pattern, paler and unicolorous tegmina, different abdominal pattern and brilliantly yellow cerci. It is not closely related to any of the South American species as far as can be determined.

Type.—♀; Suretka, Sixaola Valley, Limón Province, Costa Rica. May 31, 1924. (J. Chester Bradley.) [Academy of Natural Sciences of Philadelphia, Type no. 5460.]

Size very large for the genus (body 15.2 mm., tegmen, 17); form very similar to that of *P. intercepta;* surface polished.

Head but narrowly evident cephalad of the pronotum when seen from the dorsum, but for the entire width of the cephalic margin of the pronotum: in facial aspect the head outline is seen to be subcordiform, rather bullate across the eyes, which are appreciably protuberant laterad, the facial margins ventrad of of the eyes nearly straight oblique convergent to the buccal extremity, greatest width across eyes contained nearly one and one-fifth times in the greatest depth of the head (as 37 to 43); occipital line nearly straight, the arcuation but faintly indicated, regularly passing into the eye curvature; occipital interspace between the eyes very broad, approaching half the width of head across eyes (as 15.5 to 37), but faintly less than interspace between ocellar spots (as 15.5 to 16) and distinctly wider than distance between inner margins of antennal scrobes (as 15.5 to 11); lateral margins of face ventrad of eyes markedly cingulate. Antennae slightly longer than body, with proximal two-fifths distinctly thicker and plumose, the proximal fifth with the

plumosity sparser and shorter, but regularly increasing in length and density, in the second fifth the maximum plumosity for length and density is found; distad of the plumose section the antennae are distinctly and rather abruptly more filiform with the articles less bead-like, and with the plumosity replaced by a few scattered hairs. Palpi moderately elongate, relatively slender, penultimate joint infundibuliform, slightly shorter than the faintly arcuate antepenultimate joint, ultimate joint slightly longer than the antepenultimate, distinctly compressed.

Pronotum roughly pentagonal in outline, point of greatest width very faintly caudad of the middle, greatest width contained approximately one and one-fourteenth times, in greatest length of pronotum (as 71 to 76): cephalic margin, which is equal to three-sevenths of entire pronotal width, sharply concavo-truncate over the head, narrowly rounding laterad into caudad divergent, weakly arcuate lateral margins, which rather broadly arcuate over the points of greatest width pass into the caudad convergent, distinctly arcuate sections of caudal border, which meet mesad in a more narrowly rounded angulation than usual in this genus, the impression created being that the whole section is more produced caudad than in other species of this genus: surface of pronotum with very weakly indicated, cephalad diverging impressions; in transverse section the surface is evenly arcuate except for a faintly more marked declivent tendency laterad at the point of greatest width.

Tegmina surpassing the apex of the abdomen by a distance equal to the pronotal length, elongate lanceolate, broadest at the proximal fourth, the width there being contained one and one-fourth times in the greatest tegminal length, thence by the curvature of the costal margin narrowing distad: costal margin from base appreciably arcuate to proximal fourth, thence weakly but distinctly concave to distal third and finally slightly oblique subarcuate to the apex, which is slightly more costal than sutural in position, rounded rectangulate, passing by an oblique arcuation into the straight sutural margin: marginal field short, reltively broad; scapular field at proximal third very broad, equal to virtually half of entire tegminal width at that point (as 21 to 44); discoidal field, as usual in genus, distinctly wider at distal fourth than at proximal third (as 31 to 23); anal field elongate pyriform, covering slightly less than proximal third of tegmen: costal veins eighteen in number, those mesad quite long on account of the curvature of the discoidal vein, those distad straight oblique, those proximad oblique arcuate; discoidal vein strongly arcuate in proximal half, relatively straight

distad; discoidal sectors (including median vein) six in number, all except the median vein showing the marked flexing near the apex of the anal field which is a feature in this genus; anal sulcus sharply bent at a right angle briefly before joining the sutural margin; axillary veins seven in number. Wings long and narrow, reaching to the tegminal apices when in repose, the apex of the anterior field slightly sharper than that of the tegmina, being narrowly rounded acute-angulate; costal veins fourteen in number, the proximal four slightly arcuate and faintly inflated, the others straight oblique and simple; discoidal and median veins straight; ulnar vein triramose; axillary vein triramose.

Abdomen with surface of six proximal tergites concave to subconcave traversely, their lateral margins approximately subparallel. Tenth abdominal tergite (supra-anal plate) transverse, subtrigonally produced mesad, the converging lateral margins of the production weakly sigmoid, subconcave above the cerci, subconvex thence distad, the apex rather blunted and narrowly V-emarginate mesad, the emargination filled with a membrane; in transverse contour the tergite is distinctly medio-longitudinally tectate, the surface longitudinally concave on each side of the same, rising laterad over the cercal bases. Cerci elongate, three and one-half times as long as the tenth tergite, fusiform, the distal tapering evident and covering three articles, the apex rounded acute, the whole cercus composed of twelve articles; dorsal surface deplanate in proximal three-fifths, medio-longitudinally sulcate distad. Tenth abdominal sternite (subgenital plate) relatively broad, simple, distal margin arcuate.

Cephalic femora with ventro-cephalic margin having six large spines meso-proximad and three large spines distad, these regularly increasing in length, the distal twice as long as the more proximal one, intervening space with a number of true spines of a smaller category; ventro-caudal margin with four large spaced spines, one of which is distal. Spines on both margins of median and caudal femora and of all tibiae elongate, numerous and regularly placed.

General base color of tegmina, wings, venter of the abdomen and limbs, dark xanthine orange (of Ridgway); most of head, incrassate and plumose proximal portion of antennae, disk pattern of pronotum, meso-and metanota and disk of dorsal surface of abdomen shining black. Infra-ocular portion of genae, narrowing ventrad, and narrow edging at base of mandibles creamy white; ocellar spots light ochraceous-salmon; occasionally the face between and ventrad of antennae is marked with three triangularly disposed ochraceous-orange spots (paratype only); eyes buckthorn brown, blotched to a variable degree with fus-

cous; palpi with ultimate and penultimate joints black, antepenultimate joint of the pale base color; antennae immediately distad of incrassate and plumose section with a naples yellow annulus involving fourteen or so articles, the remainder of the filiform distal section fuscous. Pronotum buff yellow to apricot yellow, with the black disk of the shape usual in this group, the lateral emarginations of dark disk being decided and moderately acute (type) to obtuse (paratype) angulate in shape, the cephalic margin of the dark disk subtruncate mesad and obliquely truncate latero-cephalad to the lateral emarginations, caudal margin of disk broadly arcuate, the pale border caudad somewhat broader in the type than in the paratype; cingulate margins of pronotum cephalad and caudad finely pencilled with fuscous, fainter laterad. Tegmina unmarked, uniformly dark xanthine orange. Dorsum of abdomen blackish, with lateral apricot yellow borders broadening distad to the sixth tergite, these borders ceasing at the seventh tergite; tenth tergite with its distal border indefinitely margined with apricot yellow; venter of abdomen xanthine orange, indefinitely bordered laterad, to seventh sternite, with naples yellow. Cerci clear naples yellow. Femoral and tibial spines russet, the tibial markedly tipped with fuscous.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♀, Suretka, *type*	15.2	5.96	6.38	17	4
Sex?, Turrialba, *paratype*...	—[13]	5.46	5.62	15.3	3.27

In addition to the type I have before me a single specimen from Turrialba, Costa Rica, without further data, belonging to the Hebard Collection. This individual lacks the abdomen, but from its somewhat smaller size, as shown above, and its faintly narrower interocular space I feel it may be a male. The few features of color difference presented by it have been included in the color description.

Pseudomops zonata new species (Pl. XVIII, fig. 2, XIX, fig. 10.)

A striking but small species more intimately related to *P. aurantiaca* Saussure and Zehntner, from Panama, and *grata* Rehn, from Costa Rica, than any other species. From *grata* the

[13] Abdomen missing.

present species can at once be distinguished by its much smaller size, distinctive color pattern and details of the genitalia. From *aurantiaca* which is of nearly the same size, *zonata* can readily be distinguished by its bicolored tegminal and abdominal patterns, the blackish pronotum and limbs, and doubtless by distinctive genital features, but these are not mentioned in the original description of *aurantiaca*.

Type.— ♂ ; Pablobamba, Province of Sandia, Peru [14]. [Hebard Collection, Type no. 1128.]

Size very small; form elongate, very slender; surface moderately polished.

Head but narrowly evident cephalad of pronotum when seen from the dorsum; in facial aspect subcordiform, the greatest depth of head but faintly greater than the width across eyes (as 46 to 44), the infra-ocular portion of head narrowing markedly and regularly to the buccal extremity; occipital outline broadly arcuate, passing regularly into the eye outlines: occipital interspace between eyes very broad, equal to slightly more than half the entire width of the head across the eyes (as 23 to 44), the distance between the internal margins of the antennal scrobes being equal to little more than half the occipital width (as 13 to 23); distance between the ocellar spots subequal to occipital width; face ventrad of ocellar spots subtectate, an appreciable vertical median elevation extending to clypeus, the surface declivent laterad to the infra-ocular sulci. Antennae elongate, about twice as long as the body, aside from the proximal three the segments proximad are very short and transverse, thence regularly narrowing and becoming more longitudinal, until distad they are very slender and elongate moniliform; proximal third sparsely and rather briefly plumose, the passage from the proximal plumose to the more distal less evidently or not at all plumose sections being unaccompanied by any sudden size reduction in the articles, the attenuation of the antennae being uniform and gradual. Palpi subcompressed; penultimate joint infundibuliform, slightly shorter than the uniformly deep antepenultimate article; ultimate joint one and one-third times as long as the penultimate joint, in profile sublanceolate.

Pronotum roughly pentagonal, with the lateral areas distinctly

[14] This locality is in the District of Sina, on the Rio Pablobamba, a tributary of the Rio Tambopata, one of the main affluents of the Rio Madre de Dios. The elevation of Pablobamba is slightly under 2000 meters.

and obliquely decurved, caudal portion of disk impresso-deplanate: greatest length of pronotum contained one and two-thirteenths times in greatest width of pronotum (as 65 to 75), the latter at caudal fourth and twice cephalic width: cephalic margin dorsad of head arcuato-truncate, very narrowly rounding laterad into the weakly arcuate, distinctly divergent lateral margins, which broadly round over the points of greatest width to the strongly converging, lateral sections of the caudal border, these meeting in a very broad obtuse-angulation, the immediate angle of which is hardly at all rounded; all margins cingulate, the caudal more broadly so.

Tegmina elongate, lanceolate, their greatest width (at distal fourth) contained three and three-fifths times in their greatest length, the width at proximal third slightly less: costal margin very narrowly arcuate proximad, thence for a distance nearly straight, followed by an almost indefinite concavity mesad, thence straight to the relatively sharp rounding to the broad apex, which, however, is more costal than sutural in position, passing by a much broader arcuation to the nearly straight sutural margin: marginal field relatively narrow and elongate, reaching nearly as far distad as the apex of the anal field; scapular field broad, at middle of tegmina equal to width of discoidal field at same point, at distal fourth this field is half again as wide as at middle of tegmen; anal field pyriform, reaching distad nearly one-third of tegminal length: costal veins sixteen to seventeen in number, a number of the more distal ones bifurcate, those mesad faintly arcuate, the others straight or nearly so, all oblique; discoidal vein with the proximal half distinctly sinuate, distal half nearly straight; discoidal sectors, including median vein, seven in number, all the more sutural distinctly flexed near the apex of the anal field, as usual in the genus; axillary veins six in number. Wings reaching to apex of tegmina when in repose, the apex shaped as in tegmina [15].

Abdomen relatively narrow, lateral outlines as seen from venter regularly converging distad, the lateral margins elevated dorsad by ventro-lateral compression, in lateral view these margins as a whole are moderately arcuate dorsad; dorsal surface strongly concave by the elevations of the lateral margins, decreasingly so distad; antepenultimate abdominal tergite mesocaudad with a decided and sharply indicated V-shaped emargination, directed proximad; ultimate abdominal tergite (supra-anal

[15] The type being unique and quite fragile, spreading the wings to describe the venation is inadvisable, particularly as numerous clearly diagnostic features are elsewhere evident.

plate) somewhat distorted in type, apparently subtrigonal produced mesad, with the apex triangularly fissate. Cerci relatively short, about twice as long as the ultimate abdominal tergite, broad fusiform, markedly tapering in four distal segments, apex sharply acute; all segments clearly evident, dorsal surface deplanate. Ultimate abdominal sternite (subgenital plate) markedly asymmetrical; dextral side from ventrad of cercal base straight oblique to the acute apex, sinistral side strongly arcuate emarginate, a brief section proximad having the margin straight and subparallel to the same area on the dextral side, this followed distad abruptly by a rectangulate shoulder which laterad flanks the marked concave emargination, as seen from venter a short section of the margin distad straight oblique, immediately before the acute apex, when viewed from dorsum this same area is seen to have a semi-circular chitinous flap bent downward inside of the sternite; but a single style is evident, this situated proximad in the sinistral emargination, a very short, thick, decurved node; in transverse section the sternite is distinctly arcuate, curving dorsad marginally.

Cephalic limbs lacking. Median and caudal limbs elongate, femoral and tibial spines quite elongate. Caudal tarsi very slender, metatarsus nearly a third again as long as remaining tarsal joints (as 45 to 35).

Head, proximal incrassate and plumose portion of antennae, pronotum, coxae, limbs, abdomen distad of the fifth tergite and sternite and most of tegmina distad to apex of anal field, pitch black. Antennae with median ochraceous-buff annulus involving twelve or so articles, this blending into the prout's brown of the distal portion. Tegmina with the base color pale mars yellow, slightly more than distal fourth heavily washed with blackish fuscous, the proximal dark area solidly involving the anal field, adjacent portion of the mediastine field, the humeral trunk and the immediate base of the marginal field; remainder of marginal field and very narrow pencilling of costal margin of median pale area of tegmina cream white. Wings more weakly of the pale tegminal color, with distal portion of anterior field and adjacent narrow section of posterior field washed with blackish fuscous as in the tegmina. Base of abdomen both dorsad and ventrad, deep chrome yellow.

Length of body, 8.1 mm.; length of pronotum, 2.73; greatest width of pronotum, 3.15; length of tegmen, 9.9; greatest width of tegmen, 2.73.

The type of this interesting and unusual species is unique.

NYCTIBORINAE

Paratropes pensa new species (Pl. XX, fig. 2.)

Apparently more nearly related to *P. aequatorialis* Saussure, from Ecuador, than any other species of the genus, but differing in the less strongly trigonal and more subrectangulate pronotum, in the quite elongate tegmina and wings, which surpass the apex of the abdomen by half their length, in the solidly black pronotum, in the reduction of the dark tegminal markings to a narrow humeral line, a narrow sutural line and a weak costal margining proximad, and in the entirely uniform blackish color of the body.

The pronotal form is quite distinctive, being more subrectangulate than in any other species of the genus. Although the antennae are lacking, there is no close relationship to either *Eunyctibora* Shelford or *Eushelfordia* Hebard.

Type.—♂; Piches and Perené Valleys, Peru. 2000 to 3000 feet. [United States National Museum.]

Size medium; form not as strongly depressed and subdeplanate as in certain species of the genus, alar appendages more elongate than in other species; entire surface, even including tegmina and wings, with a sparse and irregularly distributed but distinctly evident vesture of short creamy white hairs.

Head subcordiform in outline, greatest width across eyes contained one and one-fifth times in greatest depth of head (as 40 to 48); eyes slightly prominent when head is seen in cephalic aspect, infra-ocular lateral borders of head arcuate convergent to buccal region; interocular area of medium width equal to two-thirds distance between the very evident but small and circular ocellar spots; area between least interocular space and ocellar spots concavo-deplanate, and with much of face cribroso-punctate, a pair of distinct large impressions situated on the lower face. Palpi with penultimate joint crassately infundibuliform, two-thirds as long as the ultimate or antepenultimate joint, which latter are subequal in length. Antennae lacking.

Pronotum transverse, its greatest length contained slightly more than one and one-half times in its greatest width, in form more subrectangulate than trigonal, and roughly describable as reversed trapezoidal with the longer dimensions arcuate or subarcuate, point of greatest width near cephalic third: cephalic margin broadly arcuate between points of greatest width, faintly more strongly so mesad over head; lateral margins markedly

arcuate convergent caudad from point of greatest width, which is well rounded, to the evident but rounded caudo-lateral angles; caudal margin markedly arcuate with a weak obtuse-angulation mesad: disk mesad with two pairs of converging oblique and straight impressions, the outer the longer, the inner the deeper, caudal transverse section of disk deplanate, supra-cephalic median area transversely arcuate, broad lateral sections subconcavely deflexed; entire surface of pronotum decidedly and thickly impresso-punctate or punctulate, more minutely so meso-cephalad, those areas latero-cephalad of lines from lateral portions of supra-cephalic area to caudo-lateral angles in addition deeply and coarsely strumoso-cribrose, the depressions forming scar-like but rounded pits.

Tegmina surpassing apex of abdomen by over twice the pronotal length, lanceolate, the greatest width (at proximal third) contained nearly three times in length of same: costal margin strongly arcuate in proximal third, thence very weakly arcuate to distal fourth, from which point it rounds more decidedly to the rounded rectangulate apex, which is at extremity of the humeral trunk; sutural margin nearly straight for four-fifths of its length, the distal fifth strongly and rather abruptly arcuate to the tegminal apex: marginal field broad, subdeplanate, reaching distad a short distance beyond apex of anal field; scapular field at widest point occupying two-fifths of total tegminal width; anal field short pyriform, its greatest width slightly less than half its length: texture of tegmina subcoriaceous, intervenational areas subareolate and the differentiation of primary venation and secondary nervures not always evident; discoidal sectors longitudinal; axillary veins eight in number, bunching suturad. Wings elongate, extremity of anterior field agreeing in general shape with distal section of tegmina, differentiation of anterior and radiate field marked in structural form and marginal outline: costal veins few, nearly longitudinal, non-clavate; medio-discoidal and medio-ulnar areas narrow, subequal in width; ulnar vein with numerous rami, four reaching the margin and the second of these (from extremity) triramose.

Tenth abdominal tergite (subgenital plate) in general form rounded, more strongly arcuate sinistrad than dextrad, but one style evident, presumably the dextral, and placed slightly dextrad of median line, a simple, short, stout styliform digit, which fits in a short concavity extending sinistrad along the margin mesad, probable position of other style not clearly evident.

Cephalic femora with ventral margins having many chaetiform hairs but no spines except distal ones. Tarsal claws marked unequal, the cephalic much the shorter.

Body color, including limbs and palpi, entirely shining black, unmarked; eyes bister. Tegmina and wings dull yellow ocher, translucent on the former and semitransparent on the latter, marked only by the following: a narrow pencilling of russet proximad on costal margin of tegmen; a decided and solidly indicated but narrow streak of pitch brown following the proximal two-thirds of the tegminal humeral trunk, paling distad; a narrow border of pitch brown of medium depth embracing the entire sutural margin of sinistral tegmen from tegminal base to apex; a weak border of hay's russet to the distal margin of the anterior field of the wing and faintly bordering the extremity of the costal border of the same.

Length of body, 20.5 mm.; length of pronotum, 5.8; greatest width of pronotum, 9; length of tegmen, 30; greatest width of tegmen, 10.5.

The type of this most striking species is unique.

Nyctibora fictor[16] new species (Pl. XIX, fig. 5, XX, fig. 5.)

A relative of *N. sericea* (Burmeister), from Brazil, and *N. laevigata* (Beauvois), from Jamaica and Hispaniola, with both of which the present species has been compared. In general size and form *fictor* closely resembles *laevigata,* but it at once can be distinguished by having the marginal field of the tegmina unicolorous with the scapular field, instead of contrastingly colored as in *laevigata,* in the form of the pronotum being more trigonal, the tegmina and wings more abbreviate, not covering the apex of the abdomen, the surface of the tegmina more sericeous, the tarsi more robust and the tenth tergite (supraanal plate) of the male symmetrically trapezoid in general outline, as in *sericea,* and not subtrigonal as in *laevigata.* From *sericea* the new species is at once separable by the more robust build, far shorter tegmina and wings, which in *sericea* exceed the apex of the abdomen by about the length of pronotum, in the pronotum being markedly trigonal in outline, instead of transversely sub-acute elliptical, in the pronotal surface being less sericeous, and in the tegmina lacking contrasting coloration. The male genital characters are essentially the same in *sericea* and *fictor,* but the other features of difference are decided, and

[16] *Fictor,* a feigner, a master in deceit, in allusion to its great superficial resemblance to the West Indian *N. laevigata* (Beauvois).

the general appearance more resembles that of *N. laevigata*. The species *fictor* is apparently an annectant type, connecting *sericea* and *laevigata*, showing the probable line of divergence of the latter from the more normal nyctiborine type. The uniform color of the tegmina is a discordant note in such an argument, but the lack of a pale marginal field may be explained by assuming that it is less fundamental that the pale pronotal border. From our knowledge of other genera of blattids this would seem to be a warranted assumption.

Type.—♂; Rio de Janeiro, Brazil. (N. Thayer Expedition.) [Museum of Comparative Zoölogy.]

Size medium: form short, ovate, robust, moderately depressed; surface of pronotum and of tegmina sericeous, dorsum of abdomen smooth, venter of abdomen and limbs rather sparsely and briefly sericeous.

Head almost entirely hidden under pronotum when seen from dorsum, cordiform in outline: occipital interspace between eyes very narrow, not more than one-half width of proximal antennal joint.

Pronotum subtrigonal in general outline, greatest length contained one and one-half times in greatest width, latter at caudal fifth: cephalic margin markedly arcuate, very brief, not as wide as head, passing into the diverging weakly arcuate lateral margins, which pass into caudal margin by rounded rectangulations; caudal margin very faintly obtuse-angulate mesad; all margins cingulate, caudal one narrowly so: in transverse section disk is convex, faintly more declivent laterad: surface with sericeous pile sparser mesad than laterad [17], disk mesad with faintly impressed sub-lyrate figure.

Tegmina falling short of apex of abdomen by faintly more than one-half of pronotal length, elliptical; costal margin arcuate, more strongly distad so than proximad, passing regularly to the rounded apex; sutural margin of similar outline, regularly passing distad to apex: marginal field short, distinctly less than half as long as tegmen, relatively broad, scapular field broad; anal field about equal in length to marginal field, broad: venation not pronounced, although evident, scapular field with numerous sectors; proximal two-fifths of humeral trunk marked by a distinct fine sulcus, apparently between the discoidal and ulnar elements; discoidal sectors numerous, longitudinal; anal sulcus distinct but delicate, its arcuation flattened disto-costad,

[17] Possibly due to abrasion of disk.

joining sutural margin at two-fifths of length of same, and at a right angle. Wings subequal to tegmina in length.

Abdomen with disto-lateral angles of proximal tergites subrectangulate, weakly produced; of distal tergites distinctly acute-angulate, appreciably but not sharply produced. Supra-anal plate (tenth tergite) moderately transverse, subtrapezoidal in outline, disto-lateral angles narrowly rounded subtruncate, distal margin with a low but distinct median lobulation; surface of plate with whole median section concave [18]. Cerci elongate, equal to twice median length of supra-anal plate, slender, tapering, joints clearly defined and increasing in length distad. Subgenital plate (tenth sternite) relatively small, weakly transverse, free margin in general form strongly arcuate, dextral side briefly oblique truncate proximad; stylar fossae asymmetrical, dextral placed in a distinct shoulder half way to distal portion of plate, sinistral placed at sinistral base of plate; styles simple, tapering, unequal in length, dextral one but two-thirds as long as sinistral.

Cephalic femora with ventro-cephalic margin having spination of distal two-thirds regular and strong, individual spines short, the distal four increasing in length with the two most distal long; ventro-caudal margin with four spaced spines on distal half; median and caudal femora with ventral margins strongly spined. Tibial spines robust. Tarsi with pronounced pulvilli, that of caudal metatarsi occupying two-thirds of length of same, of cephalic and median metatarsi occupying all of joint; arolia prominent; tarsal claws asymmetrical. Caudal metatarsi faintly shorter than remaining tarsal joints combined.

Head, except clypeus, eyes and ocelli, with greater portion of pronotum, dorsum of abdomen, venter and most of limbs pitch black. Eyes dresden brown (specimen dried from liquid preservative). Ocelli, clypeus and soft tissue of antennal scrobes, deep ochraceous-orange to mustard yellow. Lateral borders of pronotum deep and rather dull ochraceous-orange, narrowly non-confluent cephalad and regularly broadening caudad, narrowly separated from caudal margin and with immediate cingulate lateral margins of the general color. Tegmina costad between hay's russet and liver brown, on anal and discoidal fields becoming deep liver brown; normally covered portion of dextral tegmen with strong purplish iridescence. Wings ochraceous-tawny, near costal margin and apex more russet. Subgenital plate very finely edged with chamois.

[18] This may be due to drying, as the specimen was at one time immersed in some preserving fluid.

Cephalic coxae with lateral carina kaiser brown, median and caudal coxae largely washed with same, the distal lobes ferruginous. Pulvilli chamois. Pubescence pale golden.

Length of body, 26 mm.; length of pronotum, 8.1; greatest width of pronotum, 11.5; length of tegmen, 16; greatest width of tegmen, 9.

The type is unique.

Panchlorinae

Schistopeltis lizeri new species (Pl. XIX, fig. 7.)

A very distinct species of this remarkable genus, differing from the genotype, *S. peculiaris* Rehn [19], from the Rio Madeira, Brazil, in the distinctly smaller size, in the much narrower and more slit-like fissations of the cephalic margin of the pronotum, in the broader and quite differently shaped and sculptured lateral "wings" of the pronotum, and in the virtual absence of ocellar concavities. The pronotal difference alone will at once distinguish the two species.

[19] Trans. Amer. Entom. Soc. XLII, p. 240, pl. 14, figs. 16 and 17, (1916).

Type.— ♂ ; Villa Montes, Rio Pilcomayo, Chaco Boreal, southern Bolivia [20]. November, 1927. (Carlos Lizer.) [Academy of Natural Sciences of Philadelphia, Type no. 5446.]

Size smaller than in *S. peculiaris*, general form very similar.

Head strongly deplanate, broad, greatest width across eyes subequal to depth of head, general outline of head seen in facial aspect broad cordiform, in same aspect the outline of the broad interocular vertex is faintly arcuate, this interspace broader than that between ocellar spots and compared with greatest width across eyes as 19 to 45; ocellar spots oblique, subovate; face ventrad of a line between antennal bases distinctly deplanate, interocellar area with a very faint and poorly defined mediolongitudinal concavity: eyes not prominent. Palpi short, distal joints stout; penultimate joint abbreviate, not more than two-thirds as long as ultimate joint, infundibuliform, ultimate joint broad in lateral aspect, strongly subtrigonal in outline.

[20] The exact position of this locality is on or near the Rio Pilcomayo at its exit from the eastern Andes, in the Tarija Department, but a short distance due north of Borelli's classical Caiza locality. The latitude and longitude of Villa Montes would be approximately 63° 20′ W, 21° 10′ S. See the chart accompanying Lizer's "Informe sobre la Expedicion al Chaco Boliviano," etc. (In Boletín del Ministerio de Agricultura de la Nación, 1919, Buenos Aires.)

Pronotum strongly transverse, greatest length contained one and three-fourths time in its greatest width, the general form roughly elliptical, the outline flattened caudad, point of greatest width on medio-transverse axis; juxta-cephalic fissations of the cephalic margin narrow, slit-like, their depth slightly more than three times their median width, gently arcuate caudad toward median line: cephalic margin (i. e. its three parts as separated by the fissations) as a whole arcuate, its median section but slightly longer than the laterals, the angle of the latter with the incisions slightly acute; median section broadly and regularly arcuate into the fissations; broad caudal margin largely straight transverse, slightly arcuate laterad to the caudo-lateral angles, passing which the margin continues latero-cephalad in the same arcuation to the vicinity of the point of greatest width, where a small but distinct concave off-set gives prominence and a distinct angulation to the above mentioned point. Surface of the pronotum showing a pair of distinct converging impressed lines extending caudo-mesad from the heads of the fissations, these impressions becoming obsolete in a deplanate medio-caudal area, laterad of which low bosses extend to the caudo-lateral angles; supra-cephalic section of pronotum arcuate ventro-laterad, embracing the head; lateral "wings" with their dorsal surface strongly depressed, concave; a fine medio-longitudinal sulcus present; median area sparsely punctate, lateral "wings" with scattered elevated papillae or spicules, grouped particularly between the fissations and the caudo-lateral angles; margins bounding the fissations laterad appreciably thickened and substrumose, caudo-lateral portions of margin between points of greatest width and caudo-lateral angles more decidedly thickened and strumose.

Tegmina surpassing apex of abdomen by about length of pronotum, in general form as in *S. peculiaris*, greatest width contained over two and four-fifths time in its greatest length. Scapular field with a greater number of costal rami than in *peculiaris;* venation of the discoidal and anal fields similar. Wings reaching to tegminal apices when in repose; ulnar vein with six rami reaching margin and eight incomplete failing to reach same; form of apex of wing essentially that of apex of tegmina; medio-discoidal area only in part regularly quadrate areolate, a number of the cross nervures irregular and anastomosing.

Tenth abdominal tergite (supra-anal plate) broadly bilobate, median emargination very shallow and broad, lateral lobate sections broadly arcuate, the whole tergite slightly surpassing the tenth sternite in caudal extent. Cerci relatively short, subfusiform, distinctly tapering distad, immediate apex blunt, dorsal

surface subdeplanate. Tenth abdominal sternite (subgenital plate) relatively small, slightly asymmetrical; inter-stylar portion of distal margin broad, moderately biconvex, the median concavity shallow but distinct; styles inserted distinctly laterad, the dextral simple, styliform, acute distad, in length equal to about one-third of cercus, its socket occupying a very considerable portion of distal margin of sternite, and mesad bounded by an acute, cephalo-laterad directed termination of the somewhat thickened inter-stylar section of the margin; sinistral style broken in type, its socket strongly sinistral in position, small and not markedly interrupting the general contour of the margin.

Limbs with femora slightly less robust than in *S. peculiaris*, otherwise essentially the same.

General color of pronotum ochraceous-buff, becoming light ochraceous-buff on the tegmina, the abdomen both dorsad and ventrad basically ochraceous-buff, heavily overlaid with mummy brown to cinnamon-brown. Head mars brown with the face blackish chocolate; genae, mandibles, clypeus, ocellar spots and area about antennal scrobes light ochraceous-buff to ochraceous-buff; palpi mars brown, labrum tawny; eyes bister and mummy brown mottled; antennae prout's brown passing to tawny distad, two proximal segments mars orange. Pronotum with paired dark markings as in *S. peculiaris*, these blackish brown and obliquely disposed, extending laterad toward caudo-lateral angles, larger spicules of lateral "wings" finely pointed with same color; lateral margin of cephalic fissation, and caudo-lateral and caudal margins between points of great width, pencilled with russet. Tegmina with humeral trunk briefly lined with mars brown proximad; anal field and extreme base of discoidal field washed with russet, more weakly so distad. Mesonotum and, less deeply, metanotum clouded cephalad with mummy brown. Dorsal surface of abdomen with clouding rather indefinitely delimited, largely a medio-longitudinal and a pair of intermarginal longitudinal groupings; venter of abdomen somewhat similar in pattern, both laterals more broken and in part centered about the stigmatic spots, the apex of the abdomen as a whole more solidly darkened, and each sternite with a more marked concentration distad producing a transverse barring tendency. Limbs largely dull tawny on an ochraceous-buff ground, which is more evident on the tibiae and tarsi, particularly the caudal ones. Tibial spines russet, tipped with blackish brown, their sockets rimmed with same.

Length of body, 20 mm.; length of pronotum, 4.9; greatest width of pronotum, 8.6; length of tegmen, 19.4; greatest width of tegmen, 6.9.

The type of this remarkable species is unique. I take pleasure in dedicating this insect to my colleague Señor Carlos Lizer, who collected the type on the expedition made for the Argentine Ministry of Agriculture to the Bolivian Chaco, to secure information on the permanent zone of *Schistocerca paranensis*.

Phortioeca andeana new species (Pl. XX, fig. 1.)

Closely related to *P. phoraspoides* (Walker) of Central America and Colombia, but smaller (in female sex), proportionately more robust, with shorter, more subrectangulate tegmina, a more regularly arcuate cephalic margin of the pronotum, the surface of which is less deeply sculptured, the scapular field of the tegmina distad more gradually narrowing, the whole distal half of which is proportionately broader, with a broader and less concave interocular region of the head, and several color feature differences, as the absence of reddish from the pronotum and the entirely ochraceous tegmina, except for a narrow dark humeral pencilling and a similar costal edging.

The species is in no way closely related to *P. peruana* (Saussure), *apolinari* Hebard, *maximiliani* (Saussure) and *nimbata* (Burmeister), with all of which it has been compared.

The male sex of *andeana* is unknown.

Type.—♀ ; Chanchamayo, Peru. [Academy of Natural Sciences of Philadelphia, Type no. 5447.]

Size medium (for the genus) ; form robust, with tegmina exceeding apex of abdomen by not more than half of pronotal length.

Head completely hidden under pronotum when insect is viewed from dorsum ; in cephalic aspect head is broad cordiform, its greatest width across eyes subequal to depth of head ; eyes not prominent and not interrupting the general outline of head ; occipital interspace between eyes broad, slightly broader than half distance between antennal scrobes, occipital interspace outline as seen from face gently arcuate ; face appreciably deplanate, rounding laterad to the infra-antennal genae, a transverse arcuate impression indicated briefly ventrad of ocellar spots, which are distinct but small and irregular in shape, sparse punctulations scattered over face.

Pronotum cucullate, transverse, greatest length contained one and nearly three-fifths time in greatest width of same, point of

greatest width situated very slightly caudad of transverse center: cephalic margin as a whole regularly arcuate between points of greatest width except for almost imperceptible sinuations defining laterad the supra-cephalic section of the pronotum; caudal margin between caudo-lateral angles broad, equal to two-thirds width of entire pronotum, subtruncate, the arcuation being very weak, caudo-lateral angles rounded obtuse; marginal areas between points of greatest width and caudo-lateral angles short, oblique, with a slight bend at a blunt angulation briefly caudad of the rounded obtuse point of greatest width: cephalic margin of pronotum distinctly elevated and cingulate, more distinctly so mesad; supra-cephalic portion of pronotum in section moderately arcuate transversely and less decidedly so longitudinally, its boundaries formed by a pair of converging impressions, which are roughly bisinuate in contour, becoming obsolete caudad and sulcate only briefly mesad; narrow transverse caudal section slightly more elevated than supra-cephalic area, subconvex in longitudinal section, briefly deplanate near the evident "shoulders" at the caudo-lateral angles; lateral portions of pronotum appreciably declivent, caudad somewhat impressed laterad of the above mentioned "shoulders"; surface of supra-cephalic area impresso-punctate, much less distinctly so near the margin, caudad these impressions become spiculate by the elevation and extension of their cephalic margins; caudal section and lateral sections of pronotum distinctly spiculate, more closely so caudad and less thickly but more regularly so laterad, where the spicules are directed laterad.

Tegmina subrectangulate lanceolate in their general form, greatest width contained two and seven-tenths times in greatest length of same, in texture the tegmina are subcoriaceous: costal margin as a whole broadly arcuate, slightly deplanate subobliquely for some distance distad of middle, then briefly rounding to immediate apex, which is nearer costal margin; sutural margin in large part nearly straight, briefly arcuate proximad and in distal fourth broadly and decidedly arcuate to the rounded rectangulate apex: marginal and scapular fields hardly defined from one another, broad, the latter at broadest point (i. e. three-eighths of tegminal length) comprising slightly more than one-third of tegminal width, from this point regularly narrowing distad; anal field subpyriform, occupying two-fifths of total tegminal length; discoidal field broad, and due to the straight sutural margin it is of subequal width for a considerable portion of its length: costal veins not sharply distinguishable from the false neuration of the marginal field; venation of discoidal field not entirely regular, weakly radiating; axillary

veins eight to nine in number, so regularly anastomosing with the intercalated false neuration that their differentiation is difficult. Wings with shape of distal extremity of anterior field the same as distal extremity of tegmen; ulnar vein with eight considerable rami, of which five reach free margin of wing.

Tenth abdominal tergite (supra-anal plate) transverse subquadrate, with caudo-lateral angles broadly arcuate and caudal margin weakly arcuate with a very shallow and open median emargination. Styles hardly surpassing apex of tenth tergite, stout, styliform, apex bluntly acute, deplanate dorsad. Tenth abdominal sternite (subgenital plate) broad, ample, general form of margin broadly arcuate except for very shallow and broad subcercal concavities in the outline.

Limbs relatively robust. Femora unspined ventrad. Tibial spines stout and short. Tarsi with the pulvilli of the metatarsi and three following articles strongly marked; caudal metatarsi forming two-fifths of total caudal tarsal length. Tarsal claws equal, unspecialized; arolia present, not large.

Head and most of pronotum pitch brown, limbs and abdomen prout's brown to mummy brown, tegmina and wings antimony yellow. Head uniformly dark except for pale ocellar spots and the clypeus, which are antimony yellow; antennae paling distad to dresden brown; eyes brussels brown. Pronotum solidly dark except for a transverse pale area cephalad, which reaches across half of entire pronotal width, its caudal border W-shaped, while cephalad it is outlined solely by the dark pencilling of the cephalic margin. Tegmina solidly pale except for a proximal pitch brown pencilling of the costal margin, which becomes obsolete mesad, and a pronounced similarly colored infuscation of the humeral trunk, this reaching to very slightly distad of the middle of the tegmen. Mesonotum largely buff, washed with prout's brown; metanotum and dorsum of abdomen solidly prout's brown, darkening distad. Venter of abdomen, coxae and limbs prout's brown, the former becoming mummy brown distad.

Length of body, 32 mm.; length of pronotum, 9; greatest width of pronotum, 14.2; length of tegmen, 29; greatest width of tegmen, 11.

The type of this striking species is unique.

PERISPHAERINAE

The Species of the Genus Litopeltis

LITOPELTIS Hebard

1920. *Litopeltis* Hebard, Mem. Amer. Entom. Soc., no. 4, p. 140.

Genotype.—*Calolampra bispinosa* Saussure.

Having had occasion to examine a fair series of this genus [21], representing a number of species most of which were undescribed, it seemed best to record in one place my general conclusions. While there are certain discrepancies in the material examined, from the original description of *bispinosa* (Saussure), the genotype, such as smaller size, and a more numerous spination of the ventral margins of the median and caudal femora, I feel that Hebard correctly interpreted the species when erecting the genus. This conclusion has been reached entirely from the evidence in the case as independently studied and is in no way influenced by the work of my colleague.

The species of the genus here discussed are very similar in general appearance, after allowing for the decided sexual dimorphism, and the features of difference are not apparent on purely casual examination. However, the forms of the genus seem to be distinctly localized in distribution and the characters given, while sometimes obscure, are constant as far as present material goes. All of the species are secretive in habits, and, as I know from personal experience, not easy to secure. Often extensive search in an apparently favorable habitat yields no results. As in 1927 in Costa Rica this genus was particularly in my mind, but was encountered adult at but two localities of a considerable number of suitable character examined, I feel I am not overstressing the general uncertainty attending its collection. When encountered, however, it may be found in small groups, as it is gregarious to a certain extent.

The male sex of *Litopeltis* superficially looks much like the

[21] There is one statement in Hebard's generic description which was made inadvertently and requires correction. The description says "four proximal tarsal joints with ventral surfaces unarmed." While not strictly armed ventrad, in the caudal limbs these joints are marginally spinulose along the pulvilli. What was intended was to convey the fact that the cephalic and median tarsi have the proximal joints unarmed ventrad.

epilamproid genus *Leurolestes*, while the brachypterous females in general resemble species of *Audrcia* of the same subfamily. However, the relationship to *Colapteroblatta* Hebard and *Mioblatta* Saussure is clearly evident on more careful examination, and the position of *Litopeltis* is in the Perisphaerinae.

The following purely artificial keys will aid in the identification of the species as recognized by me.

Males

(Male of *musarum* not known.)

A. Tenth abdominal sternite of male symmetrical, with a distinct median produced area arcuate distad, with margins laterad equally concave, and ventral surface of plate having median area limited by short but distinct proximad converging carinulae. (Tegmina relatively ample. Interspace between eyes nearly equal to that between ocellar spots.) *calverti* new species

AA. Tenth abdominal sternite of male distinctly asymmetrical, or symmetrical with no distinct or delimited median production indicated, ventral surface of sternite non-carinulate.

B. Tenth abdominal sternite of male symmetrical. Size smaller, tegmina and wings of medium length. *bispinosa* (Saussure)

BB. Tenth abdominal sternite of male asymmetrical, distal portion of interstylar section of margin concave, sinistral portion convex or subconvex. Size larger, or, when general bulk is near that of alternative, tegmina and wings are proportionately reduced (*oreas*).

C. Interspace between eyes very narrow, little more than half juxta-occipital depth of eye (as 6 to 10) and slightly less than two-thirds of interspace between ocellar spots. (Tibiae relatively robust.) ..... *votos* new species

CC. Interspace between eyes broader, as broad as or but little narrower than (narrowest as 7 to 10) juxta-occipital depth of eye, and equal to from two-thirds to entire width of interspace between ocellar spots.

D. Tegmina and wings less ample, shorter, former not distinctly broadened in distal third. Pronotum when taken with body length proportionately larger and broader. Head as a whole proportionately narrower, eyes slightly less prominent..... *oreas* new species

DD. Tegmina and wings more ample, longer, former distinctly broadened in distal third. Pronotum proportionately smaller, as in most of the species of the genus. Head as a whole proportionately broader, eyes slightly more prominent.

E. Tegmina as a whole narrower. Tibiae of all limbs more slender. Infra-antennal areas and genae pale. Pronotum with pale lateral areas more uniformly subequal in width. Size smaller.
deianira new species

EE. Tegmina as a whole broader. Tibiae of all limbs more robust. Infra-antennal areas and genae infuscate with face. Pronotum with pale lateral areas more distinctly broadening caudad. Size larger.
biolleyi (Saussure)

Females

(Female sex of *calverti* and *votos* not known.)

A. Dorsal and ventral surfaces of abdomen solidly piceous.

B. Interocular space with eye margins regularly converging dorsad and not subparallel. Occiput and interocular space pale, contrasted with lower face. Lateral pale margins of pronotum broad, not infumate caudad.
bispinosa (Saussure)

BB. Interocular space with eye margins in large part subparallel, not regularly converging caudad. Occiput and interocular space infuscate, nearly or quite as dark as lower face. Lateral pale margins of pronotum narrower, infuscate caudad.

C. Tibiae proportionately more slender; tarsi, particularly caudal, more elongate. Tegmina longer, costal length slightly greater than greatest width, distal margin less strongly oblique, sutural margin proportionately longer.
musarum new species

CC. Tibiae more robust, median and caudal particularly distinctly deplanate; tarsi, especially caudal, shorter. Tegmina shorter, costal length no greater than greatest width, distal margin oblique, bisinuate, sutural margin proportionately shorter.....*biolleyi* (Saussure)

AA. Dorsal and ventral surfaces of abdomen with pale lateral borders. (Pale lateral pronotal areas broad, marked.)

B. Tenth abdominal tergite less strongly rectangulate transverse, distal margin from cerci broadly arcuate. Tenth abdominal sternite less transverse. Tegmina longer, distal margin transversely bisinuate; anal sulcus failing to reach distal margin by an appreciable distance... *oreas* new species

BB. Tenth abdominal tergite more distinctly rectangulate transverse, distal margin from cerci less regularly arcuate, laterad roundly obtuse-angulate with more arcuate distal portion. Tenth abdominal sternite slightly more transverse. Tegmina shorter, distal margin more obliquely bisinuate; anal sulcus nearly or quite reaching distal margin. *deianira* new species

There are a number of features which cause me to feel the female described as *L. musarum* cannot be the opposite sex of either of the males described as *L. calverti* and *L. votos*. Certain of these are the almost intangible and obscure earmarks one learns to recognize as sex correlative features. The more evident of these would point to a male with a pronotal type more like that of *L. bispinosa* than of either *calverti* or *votos*. The pronotal and facial coloration of *musarum* would also indicate a male differing in these respects from the above mentioned species.

Litopeltis bispinosa (Saussure) (Pl. XXI, figs. 7-9.)

1893. [*Calolampra*] *bispinosa* Saussure, Societas Entomologica, VIII, p. 58. [♂; "Nova Grenada."]

1893. *Calolampra bispinosa* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 67, pl. 3, fig.26. [♂ (not ♀ as stated in text); Panama.]

1914. *Audrcia marginata* Caudell, Insec. Inscit. Menstr., II, p. 77. [♀; Porto Bello, Panama.]

1920. *Litopeltis bispinosa* Hebard, Mem. Amer. Entom. Soc., no. 4, p. 142, pl. 6, fig. 23. [♂, ♀; Porto Bello, Gatun, Alhajuela, Frijoles, Buena Ventura, Boquete and Corozal, Panama.]

The above synonymy was established by Hebard in 1920 and is here given merely to complete the specific record.

I have examined that portion of the material studied by Hebard which belongs in the Philadelphia collections. No male specimen before me quite equals Saussure and Zehntner's measurements of the type, also all of the specimens show a more numerous spination of the ventral margins of the median and

caudal limbs, the details of which have been given by Hebard in his generic diagnosis. With the amount of variation known in the spination features, as set forth by him, it can readily be appreciated that a specimen having one less spine on each margin could be expected, and this would agree with Saussure and Zehntner's spination formula.

Litopeltis musarum[22] new species (Pl. XXI, figs. 1-3.)

This species, known only from the female sex, is closely related to *L. bispinosa*, but distinguishable by the pronotum being broader proportionately, particularly cephalad, with the caudal margin slightly more produced mesad and the latero-caudal angles more obtuse; in the interspace between the eyes having its lateral margins (i. e. eye margins) largely subparallel instead of converging caudad and in the occipital outline as seen in facial aspect being straighter and less arcuate; in the tegmina being slightly longer, with the anal sulcus not reaching quite to the distal margin, and in the proportionately more elongate and slender caudal tibiae.

Type.— ♀ ; Atalanta Farm, Estrella Valley, Costa Rica, September 10, 1927. (J. A. G. Rehn; shaken from dead banana leaves.) [Academy of Natural Sciences of Philadelphia, Type no. 5452.]

Size large (for the genus), larger than any specimen of *L. bispinosa* seen; form typical; surface moderately polished.

Head not evident in dorsal aspect of insect; in facial aspect seen to be cordiform in outline, nearly as broad across eyes as deep (as 38 to 40), occipital line very faintly arcuate as seen from face, nearly straight; interspace between eyes broad, subequal to that between ocellar spots, when seen in occipital aspect (i. e. cephalic aspect in normal position of head) the lateral (i. e. ocular) margins of the interspace are subparallel.

Pronotum in general form much as in *L. bispinosa* but proportionately somewhat broader, the greatest length contained one and one-fifth times in the greatest width, which is caudad in this sex of the genus; marginal outline as in *bispinosa*[23] but median production of caudal margin slightly more angulate, caudo-lateral angles slightly more obtuse than a rectangle; in

[22] In relation to the liking of species of this genus for bananas (*Musa*) as shelter, and possibly food.

[23] Figured by Hebard (Mem. Amer. Entom. Soc., no. 4, pl. 6, fig. 23, (1920)).

transverse section the lateral portions of the pronotum are less sharply declivent and the disk is slightly more deplanate and not as strongly arcuate.

Tegmina of the type characteristic of females of the genus, slightly longer than in *L. bispinosa*, costal length equal to that of pronotum, subquadrate in shape, the width distad slightly less than costal length: costal margin faintly arcuate; apex which is disto-costal in position, rounded rectangulate; distal margin sigmoid and thus arcuately concave suturad; sutural margin arcuate in proximal fourth, straight distad of this, in exposed length equal to about two-thirds of length of costal margin, disto-sutural angle very faintly rounded rectangulate: fields of tegmina essentially as in *bispinosa*, but anal proportionately narrower and it fails to reach distal margin by a distance equal to about a tenth of the exposed sutural margin: anal sulcus less regularly arcuate than in *bispinosa;* axillary veins, as indicated by the intercalated puncta, slightly more numerous than in *bispinosa*.

Abdomen with both surfaces polished, virtually no indications of marginal carinulae on the distal tergites. Eighth tergite with its lateral angulate productions slightly more acute and also less thickened, more deplanate than in *bispinosa*. Tenth tergite (supra-anal plate) transverse, between cerci slightly more so than in *bispinosa* (as 38 to 18 instead of 36 to 18 as in *bispinosa*), distal margin slightly less strongly arcuate than in *bispinosa*, surface of plate with shallow concavities laterad as in *bispinosa*, but these are not defined laterad (as in that species) by a slight but distinct arcuate and cingulate rim. Cerci very short, acute, depressed. Tenth sternite (subgenital plate) transverse with distal margin arcuate, much as in *bispinosa*.

Limbs robust, all femora and tibiae heavy, median and caudal tibiae distinctly deplanate; ventral margins of median femora armed with three to four spines on caudal margin (exclusive of apical one), of caudal femora with two spines; cephalic margin of median femora unarmed, of caudal femora with a single median spine; caudal tarsi four-fifths as long as tibiae, metatarsus comprising nearly half of tarsal length.

General color liver brown, becoming pitch brown on the abdomen (both surfaces); pale lateral areas of pronotum and tegmina pale translucent zinc orange. Head of general color, slightly paler on occiput; eyes fuscous; antennae dresden brown. Pronotum with disk solidly dark, pale lateral areas relatively narrow, slightly widening caudad, but subobsolete by infuscation of discal color briefly before caudal margin, the pale areas weakly and very narrowly connected cephalad, entire periphery distinctly pencilled with liver brown. Tegmina with anal and

discoidal fields solidly liver brown, marginal field pale, with its cribrose impressions punctate with liver brown, scapular field basically of the pale color heavily overwashed with liver brown. Limbs ochraceous-tawny, lightly washed and lineate on the femoral carinae with liver brown; tibial spines hay's russet. Abdomen solidly pitch brown. In the immature condition the pale pronotal markings are limited to a pair of small areas cephalad on each side dorso-laterad of the eyes.

Length of body, 19.5 mm.; length of pronotum, 6; greatest width of pronotum, 7.3; length of tegmen (along costal margin), 6; greatest width of tegmen, 5.2.

In addition to the type I have before me two immature specimens which I refer to this species. One, an immature female about half grown, was taken with the type, and has the same data; the other, a female in the instar preceding maturity, was taken by me at Saturno Farm, Estrella Valley, Costa Rica, September 12, 1923, also from dead banana leaves. The distal tergites in these specimens have their distal margins weakly and irregularly with seriate short longitudinal carinulae, as in the same instars of *bispinosa*.

The interocular feature of *musarum* is indicated in these immature individuals and their pronotal form accords with the type.

Litopeltis calverti[24] new species (Pl. XXI, fig. 4.)

This species can at once be separated from all the other forms of the genus known to me by the distinctive form of the tenth abdominal sternite (subgenital plate) of the male, which has a markedly produced and distinctively formed median section, yet it is symmetrical in shape. It is more nearly related to those species following it in this linear presentation than to those which precede it. With all of the succeeding species except *oreas*, *calverti* agrees in the ample alar development in the male, and in the general pronotal proportions it accords with *oreas* as well.

Type.— ♂; Banks of Reventazón River at Cachí, Costa Rica. March 10, 1910. (P. P. Calvert.) [Academy of Natural Sciences of Philadelphia, Type no. 5453.]

[24] As a slight token of appreciation of his earnest and important work in Costa Rica, and of my high personal regard, I dedicate this very distinct species to its collector Dr. Philip P. Calvert.

Size very decidedly larger than in *L. bispinosa;* general form resembling that of *L. bispinosa,* but alar appendages more ample.

Head virtually hidden under pronotum, cordiform in outline when seen in cephalic aspect, greatest width across eyes subequal to depth of head; occipital outline weakly arcuate as seen in cephalic aspect; interspace between eyes relatively broad, but slightly narrower than interspace between ocellar spots (as 10 to 10.5), lateral margins of ocular interspace (i. e. eye margins) gently concave.

Pronotum of same general type as that of *L. bispinosa* but proportionately broader and more distinctly transverse, greatest length contained one and three-tenth times in greatest width of same, which is placed at five-eighths of the greatest length; cephalic margin regularly arcuate above head, passing evenly into the obliquely diverging, weakly arcuate lateral margins, which sharply round by the point of greatest width into the short caudo-lateral sections of the caudal margin, the broad median section of which is broadly obtuse-angulate (approximately 150°) with the angle itself broadly rounded; all margins distinctly cingulate, lateral ones more broadly so: in transverse section the disk is but gently arcuate, with lateral sections appreciably and rather abruptly deflexed, surfaces of these sections shallowly concave.

Tegmina surpassing apex of abdomen by slightly more than length of pronotum, relatively broad, length no more than three times greatest width, which latter is at distal fourth, the tegmen as a whole narrowing proximad: costal margin straight in median half, gently arcuate proximad, distad strongly arcuate to the broadly rounded apex, which passes by a similar but broader arcuation into the sutural margin, the latter nearly straight in its regular exposed length: scapular field at its widest point occupying hardly more than one-fourth of tegminal width at that point; anal field elongate, occupying one-third of tegminal length: discoidal field with nine sectors, including rami, but excluding the regular intercalated false nervures; anal sulcus with its gentle and low curve continuous to distal fourth, where it is bent slightly more toward sutural margin; axillary veins thirteen in number, chiefly delimited by the seriate punctations.

Wings elongate, as a whole relatively narrow, anterior field broad, distad broadly rounded; costal veins other than those ramifying from discoidal vein indefinite and irregular; ulnar vein with three complete and eight incomplete rami.

Tenth abdominal tergite (supra-anal plate) transverse, subrectangulate; distal margin well arcuate. Cerci relatively heavy, tapering, apex blunt acute, appreciably depressed. Tenth ab-

dominal sternite (subgenital plate) symmetrical, between the stylar bases, which are distinctly lateral, the caudal section of the plate is produced in a trigonal scoop-like fashion, the distal margin of this area well arcuate between a pair of short, proximad converging surface carinulae, produced margins laterad of this section obliquely and shallowly concave, proximo-lateral sections of margin, i. e. proximad of stylar bases, sublongitudinal, gently converging distad, straight; surface of sternite with the pair of distal carinulae covering hardly more than one-fifth of length of sternite, area between carinulae shallowly impressed within these and the distal margin, immediately laterad of stylar bases are quite short, subparallel carinulae, which bound laterad shallowly concave areas extending mesad to the median pair of carinulae: styles simple, slender, short, subequal.

Median and caudal femora with ventro-cephalic margins with two spines in addition to distal one, ventro-caudal margins with three to four spines exclusive of distal. Median and caudal tibiae distinctly depressed, appreciably dilated, particularly caudal, which is subfusiform. Caudal tarsi with metatarsus comprising slightly more than half (exactly 51%) of total tarsal length.

General base color ochraceous-buff, overlaid with a pattern of hay's russet on the pronotal disk and proximal section of the tegmina. Head with occiput and face solidly marked with mars brown, weaker on the occiput, lateral margins of the infra-ocellar portion of the marking tridentate, ventrad, immediately dorsad of the clypeus, the marking is subtruncate; eyes fuscous, blotched with bister; antennae between buckthorn and dresden brown in shade. Pronotum with dark disk solid and for its entire width confluent with caudal margin, failing to reach cephalic margin by a considerable distance, as a whole the disk pattern regularly widens caudad, its lateral borders cephalad with the type of sinuation usual in that position in the genus, then straight oblique; pale lateral areas quite broad, regularly widening caudad. Tegmina with proximal clouding of tegmina covering anal field except for a pale disto-sutural section, and also weakly suffusing a proximal section of the discoidal field, distad progressively obsolete, the veins there alone slightly darker, i. e. clay color; marginal field and most of scapular field pale, the veins not darkened, although many of the cribrose impressions are punctate with the dark color. Wings with venation pencilled in clay color to buckthorn brown. Dorsum of abdomen largely washed with prout's brown of variable density, except for longitudinal lateral borders of the pale base color, depth of infuscation palest proximad, while distad it is greatest bordering the lateral pale margins and distad on each segment. Venter of abdomen similar in coloration to the dorsum of the same but

infuscation more uniformly strengthening from base to apex, the pale borders meeting on the tenth sternite. Median and caudal coxae much infuscate with prout's brown; femora with the carinae lineate with prout's brown; tibial spines russet.

Length of body, 17.5 mm.; length of pronotum, 4.7; greatest width of pronotum, 6.1; length of tegmen, 19; greatest width of tegmen, 6.5.

The type of this species, which possesses a most distinctively shaped tenth sternite in the male sex, is unique.

Litopeltis votos[25] new species (Pl. XXI, figs. 5-6.)

A species having much the same general appearance as *calverti*, but differing quite decidedly from it in the form of the tenth abdominal sternite (subgenital plate) of the male, which is appreciably but not strongly asymmetrical, and in form much as in the succeeding species. From these, however, *votos* differs in the much narrower interocular space and also from each of them in features which are mentioned in their respective diagnoses.

Type.— ♂ [26]; San Carlos, Costa Rica. (Schild and Burgdorf.) [United States National Museum.]

This species is in general so similar to *L. calverti* that the following description is almost solely of features in which *votos* differs from the description of the former species.

Size and general form as in *L. calverti*.

Head with proportions as in *L. calverti* and in shape cordiform, but more regularly narrowing ventrad of the eyes, less subconstricted at the mandibular bases; interspace between eyes narrow, but equal to slightly more than half of interspace between ocellar spots (as 6 to 11), lateral margins of ocellar interspace (i. e. eye margins) straighter dorsad than in *calverti*, there but faintly diverging; eyes with concavity of ventrocephalic margin much deeper and re-entrant, the latter thus more strongly flexing the ventral portions of the eyes.

Pronotum less strongly transverse than in *L. calverti*, more approximating that of *L. bispinosa*, greatest width contained approximately one and one-fourth times in greatest width of

[25] Named for the Votos branch of the very ancient Corobicís people, who inhabited the lower San Carlos River of Costa Rica.

[26] This specimen was reported by me a number of years ago as *Ischnoptera inaequalis* (Trans. Amer. Entom. Soc., xxix, p. 264, (1903)).

same, which is placed at five-eighths of the greatest length, as in *L. calverti*: point of greatest width with margins more distinctly obtuse-angulate and less rounded than in *L. calverti*, short caudo-lateral sections of the caudal margin straighter, less arcuate and more longitudinal than in *calverti*.

Tegmina with costal margin weakly concave mesad, otherwise much as in *L. calverti;* anal field slightly broader than in *calverti*, anal sulcus more strongly arcuate and meeting sutural margin at more nearly a right-angle.

Tenth abdominal tergite (supra-anal plate) and cerci as described for *L. calverti*. Tenth abdominal sternite (subgenital plate) asymmetrical; dextral side of margin concave from slightly laterad of the insertion of the dextral style to the transversely subtruncate margin mesad, into which the dextral concavity narrowly rounds; sinistral side of margin oblique subtruncate from briefly laterad of the sinistral style to the passage into the subtruncate median section of the margin: ventral surface of tergite with no carinulae, but it is asymmetrically impressed, a broad obliquely disposed deplanate flexing of the surface dorsad, reaching from sinistral style to the dextral point of distal section of margin, markedly interrupting the regular convexity of the surface: styles simple, short and subequal, as in *L. calverti*.

Median and caudal femora with ventro-cephalic margins with two or three (on one median femur) spines in addition to distal one, ventro-caudal margins with three to four spines exclusive of distal. Median and caudal tibiae essentially as in *L. calverti*. Caudal tarsi as in *L. calverti*.

Coloration very similar to that of *L. calverti*, and as described for that species except in the following respects. Eyes tawny, clouded with bister; antennae buckthorn brown. Tegmina with dark clouding slightly more extensive distad than in *L. calverti*, paling a little more gradually over the proximal section of the discoidal field, veins nearer snuff brown. Dorsum of abdomen with but the weakest indication of the darker area of *L. calverti*, as a whole the disk little darker than the lateral areas, which are obsoletely indicated. Venter of abdomen colored as in *L. calverti*, but the pale lateral areas are distinctly broader distad to the sixth sternite, the darker central area appreciably smaller and narrower distad to the same sternite; tenth sternite with its distal margin ochraceous as in *calverti*.

Length of body, 17.9 mm.; length of pronotum, 4.87; greatest width of pronotum, 6; length of tegmen, 18.5; greatest width of tegmen, 6.3.

The type of this species is unique.

Litopeltis biolleyi (Saussure) (Pl. XXI, figs. 10-12.)

1895. *C[alolampra]* *biolleyi* Saussure, Rev. Suisse de Zoologie, III, pp. 345, 346, 347, pl. 9, figs. 8 and 8e. [♀, Central America.]

The type of this species was probably collected by Biolley, judging from the name, and doubtless in Costa Rica. Careful comparisons have been made of the females before me with the original description and figure, and I feel certain the material here referred to *biolleyi* represents that species. The tegmina in the type are figured and described as non-attingent at the sutural margins, but this I feel is not the normal condition, instead being due to a slight artificial expansion of the tegmina in the type. Unintentional pressure in pinning can easily produce such an effect.

This species has in the male sex a distinctive shape to the propotal dark disk, as well as broadly ample and elongate tegmina and wings. Compared with its nearest relatives, i. e. *L. votos* and *L. oreas*, here described, it is seen to differ in the male sex (the only one known for *votos*) in the broader interspace between the eyes, the more elongate tegmina and wings, the distal section of the former and the anterior field of the latter appreciably broader, while the anal field of the tegmina is also longer. The tibiae of all limbs are also more elongate and more slender than in *votos*. The differences from *L. oreas* are given under that species.

The specimens before me are:

Tablazo, Candelaria Mountains, Costa Rica. Elevation, 1900 meters. September, 1906. (J. Fidel Tristán.) One male. [A. N. S. P.]

Tarbaca, Costa Rica. October, 1902. (Underwood.) One male. [A. N. S. P.]

Monte Redondo, south slope of Candelaria Mountains, Costa Rica. January, 1903. (Underwood.) Two immature individuals. [Hebard Cln.]

La Estrella de Cartago, Candelaria Mountains, Costa Rica. Elevation, 2000 meters. May. (C. Picado; in epiphytic bromeliads.) Two immature individuals. [A. N. S. P.]

Navarro, Costa Rica. Elevation, 3950 feet. July 24, 1927.

(J. A. G. Rehn; under bark of tree in forest.) One male, two females, two immature individuals. [A. N. S. P.]

Costa Rica. 1884. (De Lafon.) Two males. [Paris Museum.]

From these records it will be seen that the species occurs at various points on the north and south slopes of the Candelaria Mountains, which rim the Mesita Central of Costa Rica on the south. Tarbaca is situated on the Candelaria Mountains near Asserí, and, according to Prof. Tristán, is at an elevation of 1686 meters (5531 feet). Navarro is at the north foot of the Candelaria range, and from this relatively low elevation (3950 feet) the species ranges upward to at least 6560 feet (2000 meters) at La Estrella de Cartago. The Paris Museum material, labelled simply "Costa Rica," as well as Saussure's type, doubtless came from this general region, which is quite easy of access from the cities of Cartago and San José. The vicinity of Tablazo was one of Biolley's favorite localities and it may have been the source of the type.

The adults with full data before me measure (in millimeters) as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, Tablazo	15.3 [27]	4.6	6.3	21	6.5
♂, Tarbaca	19	4.6	6.3	23	7.4
♂, Navarro	19	4.8	6.2	22	7.5
♀, Navarro	17.4	5.5	7.5	5.4	6
♀, Navarro	17.7	5.2	7.5	5.3	5.2

An analysis of the marginal spine formula of the adults measured above shows that the number of spines varies on the ventro-cephalic margins of the median and caudal femora from one to two, and on the ventro-caudal margins of the median from three to four, and of the caudal from two to three.

The interocular space in the males varies somewhat in width, in the Tablazo individual being distinctly narrower than adjacent eye depth, slightly narrower in the Tarbaca specimen, and subequal in that from Navarro. I feel these differences are individual or environmental, and may possibly be due to

[27] Abdomen somewhat shrivelled.

elevational correlation. I have seen no specimen of *biolleyi* in which this area is as narrow as in *L. votos.*

One of the Navarro immature individuals is a female in the instar preceding maturity, while the other one is in one instar earlier. One from La Estrella de Cartago is a male in the instar preceding maturity, the other is the same sex at least one instar younger. The Monte Redondo immatures are quite young, but clearly referable here. From this data it would seem that the species is adult as early as late July and persists at least to October, while in May it is in the instar preceding maturity and all are not adult in late July.

Saussure's description of the immature condition of the species and his comments on the same [28] are quite true and to the point. The resemblance to the immature condition of *Pycnoscelus surinamensis* is, as he states, very marked.

Litopeltis oreas [29] new species (Pl. XX, fig. 6, XXI, figs. 13-14.)

A near relative of *L. biolleyi,* but at once distinguishable in the male by the more compressed head, proportionately heavier and broader pronotum and shorter alar appendages. Although the head as a whole is narrower, the interspace between the eyes in the male is subequal to that between the ocellar spots. In the female sex the tegmina are sinuato-truncate distad, with the anal sulcus not reaching the distal margin, while the head is as narrow proportionately as in the male, the occipital outline of the same is more broadly arcuate, and the tenth abdominal sternite (supra-anal plate) is less strongly transverse, with its distal margin as a whole more regularly arcuate. The surfaces of the abdomen in the female are also pale margined laterad, as in *L. deianira,* instead of uniformly blackish as in *L. biolleyi.*

Type.— ♂ ; Santa Maria de Dota, Costa Rica. January, 1909. (J. Fidel Tristán.) [Academy of Natural Sciences of Philadelphia, Type no. 5454.]

Size medium, essentially as in *L. biolleyi* except for the much more reduced alar appendages; form (with wings closed) elongate elliptical.

Head as seen in cephalic aspect, broad cordiform, the greatest

[28] Rev. Suisse de Zoologie, III, p. 347, (1895).

[29] From ὀρειάς, *belonging to the mountains,* in allusion to the habitat of the species.

width across eyes but slightly less than greatest depth (as 31 to 33), outline of the eyes dorsad and of the occiput regularly arcuate; occipital interspace between eyes quite broad, subequal to that between ocellar spots.

Pronotum of type usual in genus but more distinctly vaulted and arcuate in transverse section, areas laterad of disk distinctly declivent; as seen from dorsum greatest width of pronotum is at caudal third, greatest pronotal length contained slightly less than one and one-half times in greatest width (as 53 to 75): supra-cephalic section of margins gently arcuate, evenly passing into the similarly arcuate but obliquely divergent lateral margins, these narrowly rounding, at point of greatest width, into the caudal margin, which is broadly obtuse-angulate with the immediate angle broadly arcuate.

Tegmina surpassing the apex of the abdomen by a distance less than pronotal length, blunt lanceolate, apex broadly rounded, greatest width (at distal third) contained two and two-fifths times in greatest length: costal margin regularly arcuate, narrowly curving to the broadly rounded apex, which by a regular quadrant arcuation passes into the nearly straight sutural margin: marginal field and base of scapular field heavily impresso-punctate; scapular field at its widest point occupying nearly one-third the entire tegminal width; anal field short, occupying one-third of length of tegmen, but anal sulcus regularly arcuate, the field in consequence broader proportionately and not at all pyriform in outline: discoidal field with twelve sectors, including rami, but excluding the regular intercalated false nervures; anal sulcus evenly and regularly following the quadrant of a circle; axillary veins about twelve in number, recognizable almost entirely through the intercalated seriate punctations.

Wings as a whole broad, relatively short, reaching to apices of tegmina where alar organs are in repose, greatest width contained but one and one-half times in greatest length; radiate field proportionately broader than in the other species of the genus, at its greatest width equal to one and four-fifths times the width of anterior field at distal fourth (as 90 to 50); costal veins other than the three ramifying from discoidal vein, indefinite and irregular; ulnar vein with two complete and four incomplete rami.

Tenth abdominal tergite (supra-anal plate) in shape as described for *L. calverti*, surface of distal two-thirds appreciably deplanate compared with the more inflated proximal third. Cerci as in *L. calverti*. Tenth abdominal sternite (subgenital plate) much as in *L. votos*, but more nearly symmetrical, with dextral concavity less pronounced, the angulation near the insertion of the dextral style much less evident, and the median portion of the margin less differentiated from the oblique sinistral portion

of the margin; ventral surface of tergite much as in *L. votos* but oblique impression broader, more sharply defined and more distinctly concave: styles slightly longer than in *L. votos*, more slender and straight.

Limbs more robust than in same sex of other species of the genus, the femora particularly so. Median femora with from two to no spines on the ventro-cephalic margin, caudal femora with two spines on same margin, in both cases exclusive of distal spine; ventro-caudal margins with two to four (median) or one to two (caudal) spines exclusive of distal. Cephalic and median tibiae heavy, the latter nearly as deplanate as caudal; caudal tibiae subfusiform in outline, distinctly deplanate. Caudal tarsi slightly heavier than in *L. calverti* and *votos*, but proportions much the same.

Allotype.— ♀; same data as type, with addition of 1595 meters elevation. [Academy of Natural Sciences of Philadelphia.]

Size smaller than the same sex of *L. biolleyi;* form more regularly elliptical, the abdomen apparently not so deplanate.

Head not evident in dorsal view, in facial aspect cordiform, distinctly narrower than in female of *L. biolleyi*, greatest width across eyes contained about one and one-sixth times in greatest depth of head (as 33 to 38), instead of nearly subequal as in *L. biolleyi* (as 39 to 40); occipital line and adjacent outline of eyes regularly arcuate; occipital interspace between eyes quite broad, distinctly wider than interspace between ocellar spots (as 15.5 to 12).

Pronotum proportionately less transverse than in *L. biolleyi*, the greatest length contained one and seven-twentieths times (as 64 to 86) in the greatest width (which is caudad), as against one and forty-three hundredths times in *biolleyi* (as 61 to 87); marginal outline much as in *L. bispinosa* but caudal margin less angulate, less produced; in transverse section the disk is decidedly vaulted, the lateral sections strongly declivent, more so than in any other species of which the female sex is known.

Tegmina of the type characteristic of females of the genus, but longer proportionately, the length subequal to the pronotal length and equal to one and one-sixth times the greatest width of the tegmen (as 62 to 53), instead of subequal to greatest tegminal width as in *biolleyi*: in shape the tegmina are quadrate, costal margin arcuate, more strongly so distad than proximad, and strongly rounding to distal margin; sutural margins overlapping, gently arcuate, disto-sutural angle rectangulate, the immediate angle very narrowly rounded; distal margin sinuato-truncate, faintly arcuate produced at the extremity of the humer-

al trunk; anal field occupying not quite three-fourths of tegminal length, its axis appreciably more longitudinal than in *L. biolleyi*: anal sulcus more regularly arcuate than in *biolleyi* and joining the sutural margin a considerable distance proximad of the disto-sutural angle. Wings indicated only as minute functionless pads, completely hidden under the tegmina.

Abdomen with tergites bearing appreciable indications of regularly placed marginal carinulae. Eighth tergite with its lateral angulate productions distinctly acute, relatively thickened. Tenth tergite (supra-anal plate) transverse, but with its distal margin broadly and regularly arcuate, passing into the lateral margins with little indication of an angle (this quite evident in *biolleyi*); surface of tergite moderately and arcuately concave distad and laterad, particularly laterad. Cerci short, acute, depressed.

Tenth sternite (subgenital plate) transverse trigonal, more produced mesad than in *L. biolleyi*, its margin laterad sinuato-arcuate.

Limbs almost entirely missing in the allotype.

General color pattern of male as in *L. calverti*, *votos* and *biolleyi*, the dark base color being liver brown, to nearly pitch brown on the pronotum in the type, this dark color becoming more dilute distad on the tegmina, passing through bay in the anal and proximal section of the discoidal fields to a buckthorn brown lineation of the veins on ochraceous-buff distad; dark areas of the face, coxae and ventral surface of the abdomen pitch brown, weaker dorsad. Pale base color of head, lateral areas of pronotum, marginal and much of sutural fields of tegmina ochraceous-buff. Head with occipital region and face except ocellar spots, infra-antennal areas and genae, and also a transverse rectangulate area on the clypeus solidly dark, lateral margins of dark face marking bilobate; antennae dresden brown, becoming tawny proximad; eyes fuscous. Pronotum with the dark disk more deeply toned caudad than elsewhere, lateral margins of dark disk with the usual premedian lobulation invading the broad pale lateral areas. Tegmina with the impressed punctae of the marginal field and the proximal portion of the scapular field marked with bay. Dorsal surface of abdomen buckthorn brown proximad, passing to cinnamon-brown distad, pale lateral borders of the tergites and a broad transverse connection distad on the tenth tergite (supra-anal plate), involving the greater portion of the tergite, creamy white; venter of abdomen with similar pale lateral borders light ochraceous-buff, these continued around the free margin of the tenth sternite (subgenital plate). Coxae with external borders, narrow area distad on same and base

color of remainder of limbs buffy, the femora lineate with prout's brown as usual in the genus.

Female with the pattern and colors as in the male except as here stated. Dark face color more extensive laterad, involving virtually all of the infra-antennal areas. Pronotal disk distinctly chestnut mesad. Tegmina with anal and discoidal areas dark, between chestnut and bay, with the vicinity of the humeral trunk lined with fuscous, pale lateral area broad, involving the whole of the marginal and scapular fields, distinctly and thickly impunctate with the dark color. Dorsum and venter of abdomen chestnut brown, the tergites caudad to and including the eighth narrowly margined laterad with buff, the sternites to and including the base of the tenth as far as the cerci, similarly margined. Limbs deep buffy, marked with prout's brown to mummy brown.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, *type*	15.6	4.45	6.27	14.5	6
♂, *paratype*	13.9	4.62	6.63	16	5.75
♀, *allotype*	16	5.37	7.22	5.2	4.45

In addition to the type and allotype I have before me three paratypic males, all taken at Santa Maria de Dota by Prof. Tristán, one in January, 1907, the others in January, 1909. The 1907 specimen bears elevational data of 1600 meters, one of the 1909 specimens is labelled 1595 meters. One of these specimens, i. e. that with the longest tegmina, is measured above.

A critical examination of the paratypes shows that the most evident feature of variation is that of the length of the tegmina and wings. As the measurements show the tegmina may have the width contained as much as 2.78 in the length, as against 2.41 in the type. This fluctuation is to be expected in forms which show definite alar reduction, the primitive type probably being a fully alate one, and the reduction, while general and characteristic, may still lack stability or be governed locally by survival or adaptive factors. The number of rami of the ulnar vein of the wing may be as great as three complete and seven incomplete. As these specimens were probably collected in alcohol and a definite amount of shrivelling is indicated, I hesitate to record the slight differences in contour of the tenth sternite

noticed, the type being the best preserved in this respect. The number of spines in the ventro-cephalic margin of the median femora may be as high as three, on the ventro-caudal margin no paratypes have as few as two (found in type); on the caudal femora there may be as few as one spine on the ventro-cephalic margin and as many as three on the ventro-caudal margin.

Five immature specimens taken with the adult material in January, 1909, are before me. They represent the three instars preceding maturity. All show decided marginal carinulations on all or nearly all the tergites.

Litopeltis deianira[30] new species (Pl. XX, fig. 7, XXI, fig. 15.)

This species is more nearly related to *L. biolleyi* and *L. orcas* than it is to the other species of the genus. From *orcas*, in the male the more slender build, smaller pronotum and much more elongate and ample alar organs will at once be evident as distinguishing features, while from the more similarly proportioned male of *biolleyi* the more broadly infuscate face, the more uniformly subequal width of the pale lateral areas of the pronotum, the narrower tegmina and the more slender tibiae are recognizable features of difference. In the female sex the surfaces of the abdomen are pale margined as in *orcas*, and not uniformly blackish as in *biolleyi*, the tegmina are more quadrate than in *biolleyi* and shorter than in *orcas*, the tenth abdominal tergite (supra-anal plate) is more as in *orcas* than in *biolleyi*, while the tenth sternite (subgenital plate) is more transverse as in *orcas* and nearer that of *biolleyi* in shape. The tibiae in the female are much more slender than in *biolleyi*.

Type.— ♂; Pacayas, south-east slopes of the Volcan de Irazú, Costa Rica. Elevation, 6000-6250 feet. September 6, 1923. (J. A. G. Rehn; in tree stump on edge of mountain forest.) [Academy of Natural Sciences of Philadelphia, Type no. 5455.]

Size essentially as in *L. biolleyi*; form more slender and proportionately more elongate than in same species.

Head cordiform when seen in cephalic aspect, greatest width across eyes subequal to greatest depth of head (as 31.5 to 33): eyes slightly more prominent than in related species, their outlines dorsad not regularly passing into the gentle arcuation of

[30] *Deianira*, daughter of Oeneus and wife of Hercules.

the occiput, but slightly elevated dorsad above the same: occipital interspace quite broad, equal to that between ocellar spots.

Pronotum of the same general shape found in *L. biolleyi*, but slightly more transverse, the greatest length contained nearly one and one-third times in greatest width (as 51 to 67), which latter is at three-fifths the length from the cephalic margin, the points of greatest width very broadly rounded; caudal margin mesad with the immediate angle less rounded than in *L. biolleyi*: surface of pronotum with the subcucullate area above the head slightly more marked and more definitely embracing the head than in *L. biolleyi*, contour of surface otherwise as in *biolleyi*, impressed punctulae much more numerous and more decidedly grouped than in the above mentioned species.

Tegmina elongate lanceolate, the greatest width, which is at distal third, contained three times in the tegminal length: costal margin distinctly arcuate proximad, faintly concave mesad, distad regularly arcuate to the rather narrowly rounded apex, which is situated equidistant between the costal and sutural margins, the latter of which rounds to it evenly with the curve of the costal margin, remainder of sutural margin slightly impressed at apex of anal sulcus: marginal field as in *L biolleyi*: discoidal sectors, including rami but excluding intercalated false nervures, ten in number; anal sulcus regularly arcuate, not appreciably bent before reaching the sutural margin, as in *L. biolleyi;* axillary veins seven in number.

Tenth abdominal tergite (supra-anal plate) as in related species. Tenth abdominal sternite (subgenital plate) essentially as in *L. votos* and *L. biolleyi*, but in exact minutiae near that of *votos*.

Limbs more slender than in the other species of the genus, the tibiae and tarsi particularly so, the median and caudal tibiae not at all fusiform, the width nearly subequal. Median femora with one to two spines on the ventro-cephalic margin in addition to the distal one, ventro-caudad with two marginal spines; caudal femora with a single median spine on the ventro-cephalic margin exclusive of distal one, ventro-caudad with three marginal spines. Caudal metatarsus slightly shorter than remaining joints of the tarsus (as 42 to 48).

Allotype.—♀; Pacayas, south-east slopes of the Volcan de Irazú, Costa Rica. Elevation, 6250 feet. September 5, 1923. (J. A. G. Rehn; in dead wood on ground.) [Academy of Natural Sciences of Philadelphia.]

The following features are chiefly those of difference from the description of the female sex of *L. oreas*.

Size much as in *L. oreas;* form as a whole more nearly as in *oreas* but tegminal form much nearer that of *L. biolleyi.*

Head but narrowly evident in dorsal view, in facial aspect cordiform but broader than in *oreas* and intermediate in proportions of greatest width across eyes to depth of head between those found in *L. oreas* and *biolleyi* (as 33 to 36); occipital interspace between eyes quite broad, as in *L. oreas,* that between ocellar spots faintly narrower than in that species, the ratio between the two being as 15.5 to 11.5.

Pronotum with proportions nearly as in *L. oreas,* less strongly transverse than in *L. biolleyi* (as 51 to 71): in transverse section the pronotum is intermediate in vaulting between *oreas* and *biolleyi,* less strongly so than in the former, more distinctly so than the latter, lateral declivent sections similarly intermediate in the angle of their slope.

Tegmina in length more nearly as in *L. biolleyi* than in *oreas,* while their general outline is subquadrate, in this more approximating *oreas,* although the tegmina are differently shaped distad; costal length of tegmina subequal to pronotal length and equal to the greatest (distal) tegminal width (as 50 to 50): costal margin broadly and regularly arcuate, disto-costal angle as in *oreas;* distal margin with external third truncate, internal two-thirds not strongly but appreciably concave, so that the sutural margin is appreciably shorter than the costal one, disto-sutural angle narrowly rounded rectangulate: anal sulcus joining sutural margin very briefly before disto-sutural angle.

Abdominal tergites with marginal carinulae as in *L. oreas.* Tenth abdominal tergite (supra-anal plate) with its proportions more nearly those of *L. oreas* than the ratio found in *L. biolleyi,* but distal margin less strongly arcuate, more differentiated from lateral margins; surface of tergite subexcavate intermarginally, more narrowly so than in *L. oreas.* Tenth abdominal sternite (subgenital plate) as in *L. oreas,* much less transverse, more vaulted and less deplanate than in *L. biolleyi.*

Limbs for the sex distinctly slender, much less inflated and robust than in *L. biolleyi,* the tibiae not at all as strongly deplanate, or in the case of caudal ones subequal in width and non-fusiform. Median femora with ventro-caudal margin with a single median spine (exclusive of distal one), with two spines on the ventro-caudal margin. Caudal femora with one spine (exclusive of distal one), on ventro-cephalic margin and one to two spines on the ventro-caudal. Caudal metatarsus distinctly shorter than remaining tarsal joints (as 16 to 21).

Color pattern of male in general as in related species, the dark area of the pronotal disk deep liver brown, almost pitch brown mesad, passing through bay proximad on the anal field and the immediate base of the discoidal field of the tegmina,

thence distad on the discoidal field indicated only as a dresden brown to buckthorn brown pencilling of the principal veins on a pale testaceous ground. Broad pale lateral areas on the pronotum, the anal and most of the sutural fields of the tegmina antimony yellow. Head with genae, mouth-parts and ocellar spots ochraceous, the occiput and upper face chestnut-brown, passing to pitch brown on the infra-antennal areas and base of clypeus; antennae with proximal joint tawny, thence prout's brown passing to dresden brown; eyes bister speckled with reddish. Pale marginal field of tegmina and vicinity of mediastine vein with the impressed punctae marked with bay; over much of the discoidal field the short cross-nervures are weakly touched or clouded with prout's brown; vicinity of humeral trunk in proximal third and anal sulcus in same area lined with pitch brown. Dark disk of dorsal surface of abdomen weak mummy brown, with broad lateral margins of weak yellow ocher: ventral surface of abdomen with dark disk hay's russet, overwashed with pitch brown, more weakly so proximad, where the darker overlay is more lateral than median; broad pale lateral margins of ventral surface marked and nearly as pale as antimony yellow, these narrowly continued around the free margin of the subgenital plate, the disk of which is solidly pitch brown. Limbs dark ochraceous, the coxae and to an extent the cephalic femora washed with prout's brown, tibial spines orange rufous.

Color pattern of female resembling that of *L. oreas*. General dark color ranging from deep liver brown to pitch brown; pale color ranging from ochraceous-buff to nearly zinc orange. Head as in *oreas*. Pronotum with pale lateral areas slightly narrower than in *oreas*. Tegminal pattern as in *oreas*, but anal and discoidal fields as a rule more nearly bay than the pronotal disk. Dorsum of abdomen nearly or quite pitch brown, the pale lateral borders relatively narrow, present distad to seventh tergite, semi-elliptical on each; venter of abdomen pitch brown with the pale lateral margins extending distad to the cercal bases, as in *L. oreas*. Limbs deep ochraceous, clouded with brownish on coxae and more weakly so on cephalic femora; tibial spines orange rufous.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, Pacayas, *type*	16.2	4.28	5.62	19	6.2
♀, Pacayas, *allotype*	15	4.28	5.96	4.2	4.2
♀, Pacayas, *paratype*	16.8	4.7	6.8	4.62	4.53

In addition to the type and allotype I have before me three paratypic females, two bearing the same data as the type, the other taken by me between Cervantes and Pacayas, south-east slopes of the Volcan de Irazú, Costa Rica, elevation 4800-5900 feet, September 8, 1923, (under dead wood in forest). The measurements given above show the extent of size variation in this series. Aside from a slight fluctation in the exact curvature of the distal margin of the tegmina these specimens show no noteworthy structural variations.

CARIACASIA[31] new genus

This genus, a member of the subfamily Perisphaerinae, is related on one hand to *Litopeltis* Hebard, reviewed in the preceding pages, on the other to *Mioblatta* Saussure[32]. In its general appearance it would seem like a large edition of *Mioblatta*, but the examination of details shows at once that *Cariacasia* is quite different in many features of generic importance, and similar comparison with *Litopeltis* brings out the same situation on that hand.

From *Mioblatta* the present genus can at once be distinguished by its non-pubescent surface and the non-carinulate pronotum; by the anal field of the tegmina having a form and structure more normal for the group, not broadly obtuse distad, and with the anal sulcus of normal curvature; by the presence of intercalated nervures and well developed cross nervures in the tegminal discoidal field; in the structure of the venation of the anterior field of the wing being as in *Litopeltis* and without the characteristic specialization of *Mioblatta;* in the ulnar vein of the wing having the incomplete rami over three times as numerous as the complete rami; while the genital appendages of the male are much as in *Litopeltis.*

From *Litopeltis* the sharply characteristic features of difference of the present genus are the elongate and *Cyrtotria*-like form (as in *Mioblatta*), the markedly cucullate pronotum (like

[31] From the name *Cariacas,* applied by the Spaniards to one of the stocks of the Carib aborigines found by Columbus inhabiting eastern Costa Rica.

[32] Revue Suisse de Zoologie, III, pp. 14 and 57, pl. I, figs. 15, 15a, 15b, and 15c, (1895). Genotype.—*M. fornicata* Saussure, (Brazil).

Mioblatta), the heavily punctate head and pronotum (as in *Mioblatta*), the deep, narrow and strongly pyriform head, the scantier tegminal venation, and the unspined femora (as in *Mioblatta*).

The features of the female sex cannot be considered as that sex is unknown in *Mioblatta* and *Cariacasia*.

Generic Characters.—Form elongate and slender, cyrtotriform, fully alate, surface moderately polished, without evident pubescence (female sex unknown). Head elongate pyriform in outline; face subdeplanate, and with occiput punctate. Pronotum subcucullate, strongly but regularly concavo-declivent laterad, outline from dorsum much as in *Litopeltis* but narrower; surface punctate, non-carinate mesad. Tegmina elongate, surpassing apex of abdomen; discoidal field with distinct intercalated nervures and regularly placed cross-veins, basic venation of same and anal fields well indicated. Wings fully developed; ulnar vein with both complete (three) and incomplete (eleven) rami; anterior field essentially as in *Litopeltis*. Male abdominal structure much as in *Litopeltis*. All femora with ventral margins unspined. Tarsal claws symmetrical.

Genotype.—*Cariacasia capucina* new species.

The whole appearance of the male sex of *Cariacasia* is similar in its generalities to that of species of the African genus *Cyrtotria*, and the same is true to a considerable degree of *Mioblatta*. On the other hand the same sex of *Litopeltis* superficially looks more like the epilamproid genus *Leurolestes*. The relationship of the two genera here treated is, however, more intimate than a casual glance, even at individuals of the same sex, would indicate.

Cariacasia capucina new species (Pl. XIX, figs. 6, 11-12, XXI, fig. 16.)

Type.—♂; Carillo, Costa Rica. August to September, 1903. (Underwood.) [Hebard Collection, Type no. 1123.]

Head deep and relatively narrow, greatest width across eyes contained one and one-ninth times in depth of head (as 35 to 39), the ventral three-fifths of head narrowing ventrad; eyes not distinctly prominent, the occipital outline slightly more strongly arcuate than eye curvature and thereby slightly projecting; occipital interspace very faintly narrower than space between ocellar spots (as 11 to 12), the latter large, rectangulate, obliquely disposed, converging ventrad; in profile the eyes

and face are seen to be appreciably deplanate, the occiput transversely subtectate, transversely between the ventral points of the ocellar spots is placed a deeply impressed or subexcavate lunate area, impressed punctae of occiput and face decided but not large, in general symmetrically disposed. Antennae not more than two-thirds as long as the body. Palpi small; penultimate joint equal to three-fourths the length of the antepenultimate joint and to two-thirds that of the ultimate joint.

Pronotum with its cucullate tendency distinctly evident, the deflexed lateral areas appreciably concave, recurving moderately to the lateral margins; in shape the pronotum is roughly heptagonal, with its greatest length contained one and two-thirteenths (as 65 to 75) in the greatest width, which is slightly caudad of the caudal third: cephalic margin regularly and considerably arcuate, passing evenly into the divergent, gently arcuate lateral margins, the points of greatest width being narrowly rounded obtuse-angulate; brief oblique and nearly straight postangular sections of the margin pass into the broadly obtuse-angulate halves of the caudal margin, these being faintly undulate and with their immediate angle broadly arcuate; all margins distinctly cingulate, very narrowly and finely so cephalad, broadly and heavily so caudad: surface with impressed punctae decided, rather generally distributed, except as specified, but roughly patterned, the punctae heavily and cribrosely indicated in the lateral concave "gutters," while the general vicinity of the caudal margin has few or no punctae, is smoothly polished and slightly declivent caudad.

Tegmina surpassing abdomen by pronotal length, lanceolate, relatively narrow, greatest width, which is at distal third, contained slightly more than three times in tegminal length: costal margin nearly straight proximad, then very faintly concave, rounding distad to the apex, which is slightly more costal than sutural in position and while narrow is well rounded; sutural margin straight proximad and mesad, arcuate thence to the apex: marginal field short, but proximad relatively broad and with its angle at base of costal margin rounded rectangulate; scapular field relatively narrow; discoidal field relatively broad, at distal third of tegmen occupying nearly four-fifths of entire tegminal width; anal field in shape much resembling that of *Litopeltis biolleyi*: discoidal sectors, including true rami but not intercalated nervures, eleven in number, the intercalated nervures regularly placed and strongly indicated, the cross-veins evenly disposed and well indicated, giving an evident rectangulate or more rarely quadrate pattern of areolae; anal sulcus with distal fourth appreciably but not strongly bent and joining the

sutural margin at its proximal third; axillary veins clearly evident, eight in number. Wings with their greatest width contained one and two-thirds times in their greatest length, greatest width of anterior field contained nearly twice in greatest width of radiate field: costal margin nearly straight except in distal fourth, where it rather sharply rounds to the apex, which duplicates the curvatures of the tegminal apex: costal veins weak, poorly defined; discoidal vein largely straight; ulnar vein with three complete and eleven incomplete rami, the proximal ones very short.

Abdomen with dorsal surface distinctly deplanate, little declivent laterad; eighth tergite with lateral angulate productions rounded acute. Tenth abdominal tergite (supra-anal plate) much as in *Litopeltis*, transverse with the distal margin broadly arcuate, passing into brief lateral sections, juxta-cercal in position, which are subparallel and nearly straight: surface of tergite distinctly depressed and subcoriaceous in distal two-thirds, proximad weakly inflated. Cerci short, relatively stout, tapering, apex acute, subdeplanate dorsad.

Tenth abdominal sternite (subgenital plate) much as in *Litopeltis* but virtually symmetrical, the distal margin arcuate between stylar bases, the curvature slightly more decided on dextral than on sinistral side, the styles inserted in a slight pocket immediately ventrad of the cercal bases; styles small, short, acute, subequal; ventral surface of plate with a weak indication of the sinistral oblique impression found in *Litopeltis*, reaching from base of sinistral style to slightly dextrad of the middle.

Limbs relatively short and stocky, the femora particularly thickened and the tibial spines closely placed and sturdy, in all possibly a fossorial development. All femora unarmed ventrad. Caudal tibiae subdepressed, non-fusiform in shape, faintly widening distad. Caudal tarsi with metatarsus comprising distinctly less than half of entire tarsal length (as 38 to 83), the spination of the ventral margins of the metatarsus covering little more than distal half of margins; metatarsus and three succeeding tarsal joints with highly developed pulvilli.

Base color above and below ochraceous-buff, the basic wash of the tegmina and anterior field of the wings very dilute cinnamon-buff; head and pronotum almost entirely, and greater portion of the anal and immediately proximal section of the discoidal fields of the tegmina and much of the venter of the abdomen, mahogany red to burnt sienna. Head with the dorsal and cephalic aspects almost entirely of the dark overlay color except for the pale lateral occipital borders, ocellar spots, clypeus, mouth-parts and palpi; antennae distad of the two pale

proximal joints, walnut brown, weakly paling distad; eyes fuscous, blotched with cinnamon-brown and ochraceous-tawny. Mahogany red dorsal surface of pronotum bearing an indefinite pattern of blackish fuscous, this made up of a median sublyrate figure and lateral scroll-like markings, which converge cephalad; latero-cephalad are situated at the margin and dorsad of the lateral portions of the eyes, areas of the pale base color, more distinctly blending into the dark color caudo-laterad than mesad, where the definition is sharper. Tegmina with the dark clouding proximad gradually becoming obsolete, its limiting border being oblique; humeral trunk and adjacent portion of mediastine vein heavily and broadly marked with mahogany red as far distad as middle of anal field, the discoidal vein more narrowly pencilled with the same for the greater portion of its length, discoidal sectors lightly pencilled with proximal dark color, progressively weakened distad. Wings lightly pencilled with mummy brown to dresden brown. Dorsum of abdomen with disk weakly and rather irregularly infuscate and blotched with prout's brown on the dark base color, broad lateral pale marginal areas distinct distad to eighth tergite; venter of abdomen with dark disk laterad clouded with mummy brown, in the more proximal segments thus occupying almost the entire disk; pale marginal areas as on dorsal surface, reaching in a greatly narrowed condition about the free margin of the tenth sternite. Cerci and limbs ochraceous-buff, the mesopleura, metapleura and median and caudal femora blotched with fuscous; tibial spines russet.

Length of body, 19.2 mm.; length of pronotum, 5.46; greatest width of pronotum, 6.27; length of tegmen, 20; greatest width of tegmen, 6.4.

The type of this striking and interesting new genus and species is unique.

PLATE XVIII

Fig. 1.—*Dendroblatta callizona* new species. Dorsal view of male (type). Bartica, British Guiana. (X 4.)

Fig. 2.—*Pseudomops zonata* new species. Dorsal view of male (type). Pablobamba, Peru. (X 4.)

Fig. 3.—*Euphyllodromia elegans* (Shelford). Dorsal view of female. Nouveau Chantier, French Guiana. (X 4.)

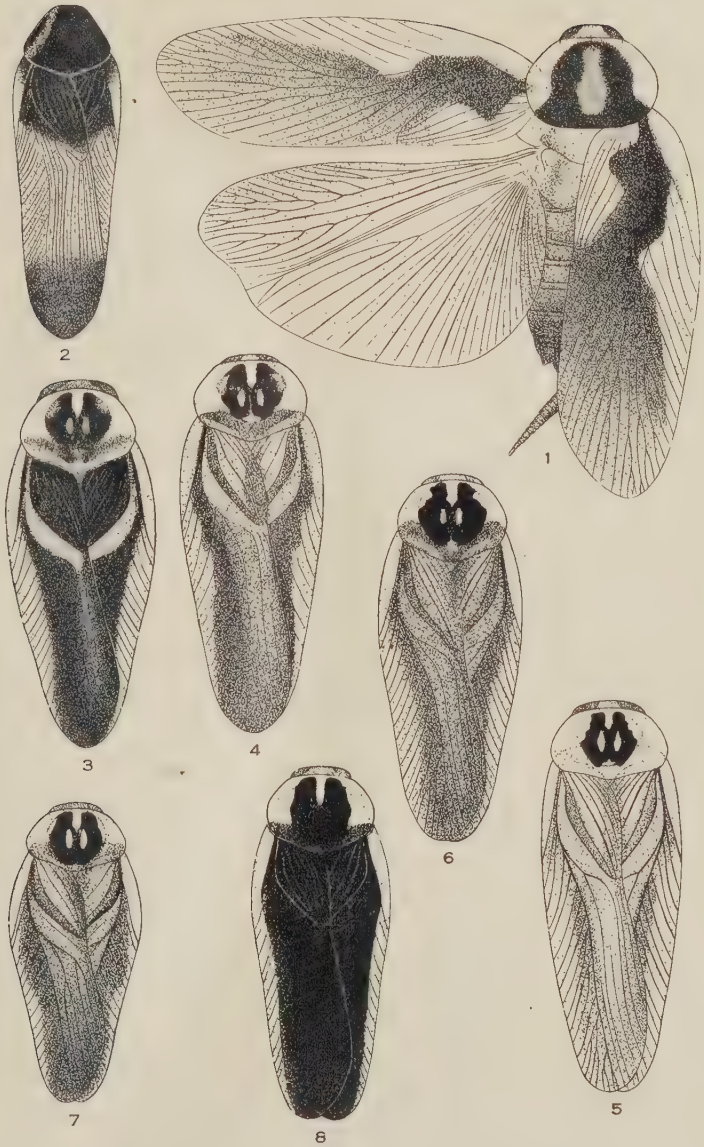
Fig. 4.—*Euphyllodromia atropos* new species. Dorsal view of female (type). Mallali, British Guiana. (X 4.)

Fig. 5.—*Euphyllodromia tupi* new species. Dorsal view of male (type). Pará, State of Pará, Brazil. (X 4.)

Fig. 6.—*Euphyllodromia jugata* new species. Dorsal view of male (type). Provincia Sara, Bolivia. (X 4.)

Fig. 7.—*Euphyllodromia boliviensis* (Shelford). Dorsal view of female. Azupizú to Miriantiriañi, Peru. (X 4.)

Fig. 8.—*Euphyllodromia nigrochlamys* new species. Dorsal view of male (type). Iquitos, Peru. (X 4.)



REHN—NEOTROPICAL BLATTIDAE

PLATE XIX

Fig. 1.—*Ischnoptera hercules* new species. Dorsal view of apex of abdomen of male (type). Kartabo, British Guiana. (Greatly enlarged.)

Fig. 2.—*Dendroblatta callizona* new species. Dorsal view of apex of abdomen of male (type). Bartica, British Guiana. (Greatly enlarged.)

Fig. 3.—*Dendroblatta callizona* new species. Ventral view of apex of abdomen of male (type). Bartica British Guiana. (Greatly enlarged.)

Fig. 4.—*Dendroblatta callizona* new species. Caudal view of apex of abdomen of male (type). Bartica, British Guiana. (Greatly enlarged.)

Fig. 5.—*Nyctibora fictor* new species. Dorsal view of apex of abdomen of male (type). Rio de Janeiro, Brazil. (Greatly enlarged.)

Fig. 6.—*Cariacasia capucina* new genus and species. Wing of male (type). Carillo, Costa Rica. (X 3.)

Fig. 7.—*Schistopeltis lizeri* new species. Dorsum of pronotum of male (type). Villa Montes, Bolivia. (X 2.)

Fig. 8.—*Pseudomops praeclara* new species. Dorsum of pronotum of male (type). Suretka, Costa Rica. (X 3.)

Fig. 9.—*Pseudomops praeclara* new species. Cercus of male (type). Suretka, Costa Rica. (X 3.)

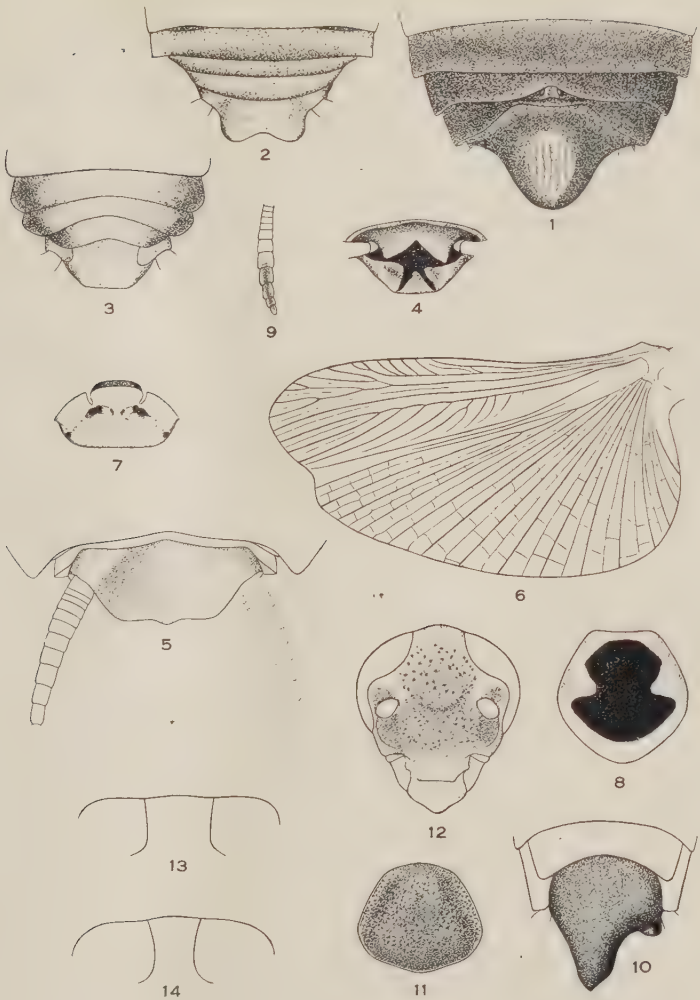
Fig. 10.—*Pseudomops zonata* new species. Ventral view of apex of abdomen of male (type). Pablobamba, Peru. (Greatly enlarged.)

Fig. 11.—*Cariacasia capucina* new genus and species. Dorsal view of pronotum of male (type). Carillo, Costa Rica. (X 3.)

Fig. 12.—*Cariacasia capucina* new genus and species. Cephalic aspect of head of male (type). Carillo, Costa Rica. (X 8.)

Fig. 13.—*Euphyllodromia atropos* new species. Cephalic outline of interocular area of male (type). Mallali, British Guiana. (Greatly enlarged.)

Fig. 14.—*Euphyllodromia tupi* new species. Cephalic outline of interocular area of male (type). Pará, State of Pará, Brazil. (Greatly enlarged.)



REHN -NEOTROPICAL BLATTIDAE

PLATE XX

Fig. 1.—*Phortiocca andeana* new species. Dorsal view of female (type). Chanchamayo, Peru. (X 1½.)

Fig. 2.—*Paratropes pensa* new species. Dorsal view of male (type). Piches and Perené Valleys, Peru. (X 1½.)

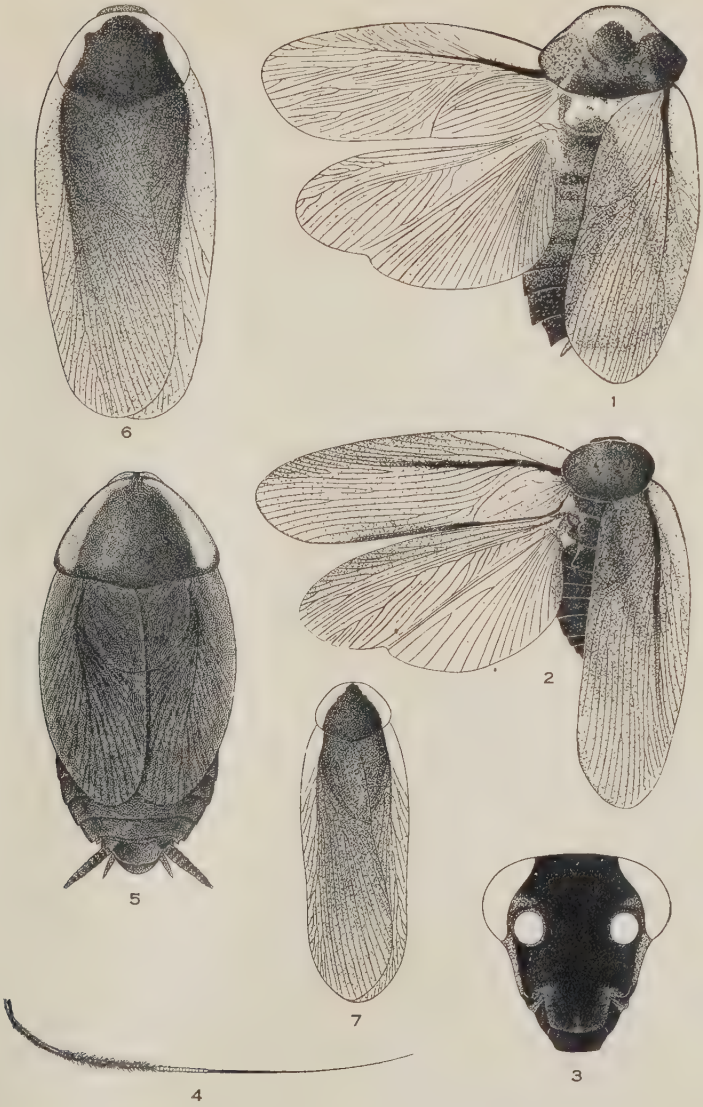
Fig. 3.—*Pseudomops praeclara* new species. Cephalic aspect of head of male (type). Suretka, Costa Rica. (X 8.)

Fig. 4.—*Pseudomops praeclara* new species. Antennae of male (type). Suretka, Costa Rica. (X 3.)

Fig. 5.—*Nyctibora fictor* new species. Dorsal view of male (type). Rio de Janeiro, Brazil. (X 2.)

Fig. 6.—*Litopeltis oreas* new species. Dorsal view of male (type). Santa Maria de Dota, Costa Rica. (X 3.)

Fig. 7.—*Litopeltis deianira* new species. Dorsal view of male (type). Pacayas, Costa Rica. (X 2.)



REHN—NEOTROPICAL BLATTIDAE

PLATE XXI

Fig. 1.—*Litopeltis musarum* new species. Dorsal outline of pronotum and tegmina of female (type). Estrella Valley, Costa Rica. (X 3.)

Fig. 2.—*Litopeltis musarum* new species. Cephalic aspect of interocular region of female (type). Estrella Valley, Costa Rica. (Greatly enlarged.)

Fig. 3.—*Litopeltis musarum* new species. Outline of caudal limb of female (type). Estrella Valley, Costa Rica. (X 4.)

Fig. 4.—*Litopeltis calverti* new species. Ventral aspect of tenth sternite (subgenital plate) of male (type). Rio Reventazón, near Cachí, Costa Rica. (Greatly enlarged.)

Fig. 5.—*Litopeltis votos* new species. Cephalic aspect of interocular region of female (type). San Carlos, Costa Rica. (Greatly enlarged.)

Fig. 6.—*Litopeltis votos* new species. Ventral aspect of tenth sternite (subgenital plate) of male (type). San Carlos, Costa Rica. (Greatly enlarged.)

Fig. 7.—*Litopeltis bispinosa* (Saussure). Dorsal aspect of pronotum of male. Gatun, Canal Zone, Panama. (X 3.)

Fig. 8.—*Litopeltis bispinosa* (Saussure). Ventral aspect of tenth sternite (subgenital plate) of male. Gatun, Canal Zone, Panama. (Greatly enlarged.)

Fig. 9.—*Litopeltis bispinosa* (Saussure). Cephalic aspect of interocular region of female. Gatun, Canal Zone, Panama. (Greatly enlarged.)

Fig. 10.—*Litopeltis biolleyi* (Saussure). Ventral aspect of tenth sternite (subgenital plate) of male. Navarro, Costa Rica. (Greatly enlarged.)

Fig. 11.—*Litopeltis biolleyi* (Saussure). Dorsal outline of pronotum and tegmina of female. Navarro, Costa Rica. (X 3.)

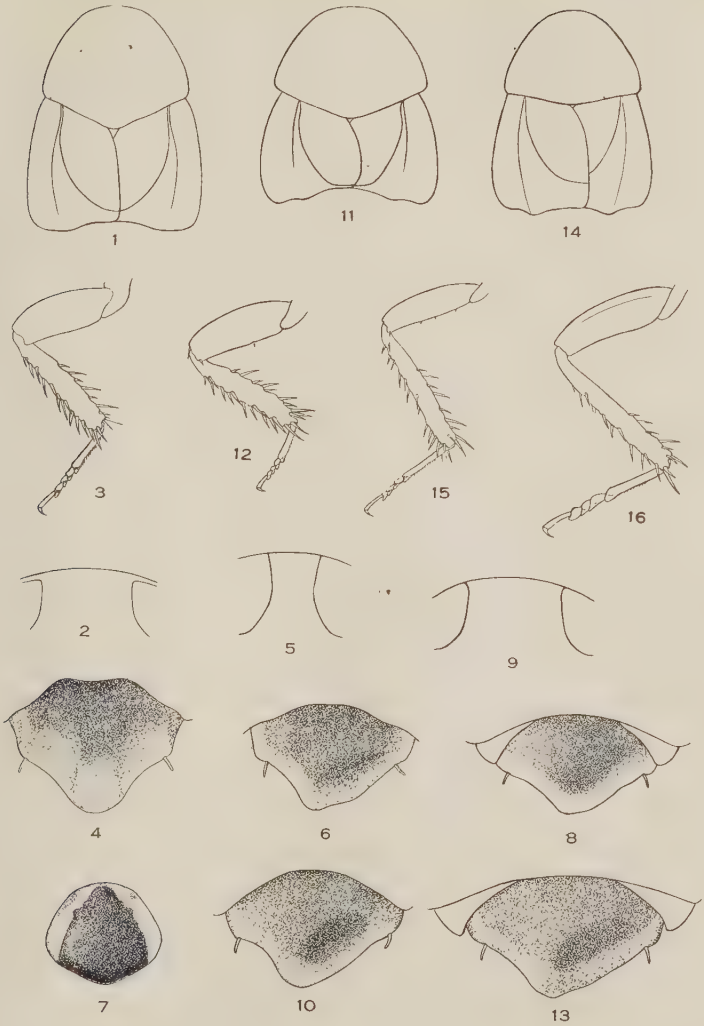
Fig. 12.—*Litopeltis biolleyi* (Saussure). Outline of caudal limb of female. Navarro, Costa Rica. (X 4.)

Fig. 13.—*Litopeltis oreas* new species. Ventral aspect of tenth sternite (subgenital plate) of male (type). Santa Maria de Dota, Costa Rica. (Greatly enlarged.)

Fig. 14.—*Litopeltis oreas* new species. Dorsal outline of pronotum and tegmina of female (allotype). Santa Maria de Dota, Costa Rica. (X 3.)

Fig. 15.—*Litopeltis deianira* new species. Caudal limb of male (type). Pacayas, Costa Rica. (X 4.)

Fig. 16.—*Cariacasia capucina* new genus and species. Caudal limb of male (type). Carillo, Costa Rica. (X 5.)



REHN—NEOTROPICAL BLATTIDAE

A REVISION OF THE NEW WORLD SPECIES OF TRIELIS A SUBGENUS OF CAMPSOMERIS

(HYMENOPTERA: SCOLIIDAE)

BY J. CHESTER BRADLEY

Cornell University, Ithaca, New York.

It has long been felt by students of the Scoliidae that the division of the family into genera and subgenera on the basis of the number of discoidal and of cubital cells in the forewing was merely a matter of convenience rather than of natural relationship. The admirable researches of Dr. J. G. Betrem, very recently published[1] seem to show that this is not the case and that there are three genera distinguished by important morphological differences, correlated in the main with the more usually employed matter of the presence and position of the second recurrent vein, or its absence.

Dr. Betrem distinguishes between the two of these three genera that occur in America, as follows:

Key to the American genera of Scoliidae

A. Mesopleura with a shoulder below the wing base which has a distinct dorsal surface; crest of the mesopleura directed towards the wing base; volsellae always undivided; the second recurrent vein never arising from the cubital cells but either lacking or arising from the first recurrent vein; two or three cubital cells; spurs of the hind tibiae never broadened apical-

[1] 1. Zur Erforschung des Persischen Golfes. (Beitrag Nr. 9.) Scoliidae (Hym.). (Entomologische Mitteilungen, 1 July 1927. XVI, p. 288-296.)

2. [Genera and subgenera of Scoliidae.] p. XCIII-XCVIII (*In* Nederlandsche Entomologische Vereiniging. Verslag van de twee-en-tachtigste Zomervergadering der Nederlandsche Entomologische Vereeniging, gehonden te Vaalg, op Zaterdag, 28 Mei, 1927, des Morgens te 11 Uur. Tijdschrift voor Entomologie, LXX, p. li-c, Oct. 1927.)

3. Monographie der indo-australischen Scoliiden (Hym. acul.) mit zoogeographischen Betrachtungen. Wageningen, Press of H. Veenman & Zonen, 1928. 2 p. l., 388p. 5 pl. (Instituts scientifiques de Buitenzorg "'s Lands plantetuin". Treubia. Recueil de travaux zoologiques, hydrobiologiques et oceanographiques., IX, Supplement).

ly; hind margins of the tergites never light colored; sexual dimorphism not greatly developed.....*Scolia* Fabricius

AA. Mesopleura dropping gradually away from beneath the wing base, without a shoulder or dorsal surface; crest of the mesopleura directed toward the angle of the pronotum; volsellae always transversely divided; wings often with two recurrent veins [always in American species], the second always arising from the second cubital cell never united with the first; two or three cubital cells; spurs of the hind tibiae at times widened at their apices; hind margins of the tergites often light colored; sexual dimorphism strongly marked.
Campsomeris Guérin

Dr. Betrem divides the genus *Campsomeris* into subgenera and species groups on characters which are not completely correlated with the presence of two or three cubital cells. It therefore occurs that some of the species with three cubital cells are placed in a new subgenus called *Pseudotrielis*, while others, including the type of *Trielis*, are placed in a species-group of *Dielis*. But this realignment of the species of *Campsomeris* has developed as yet in only a preliminary way, and it is not possible to apply it to the American fauna without further clarification. I therefore use the term *Trielis* in this paper in the sense customary to authors, and not as restricted by Dr. Betrem.

Trielis in the New World is nearly confined to the Sonoran Zone of the western United States and northern Mexico. One very rare subspecies is confined to the Austroriparian. A single species (and specimen) is known from south of Mexico, coming from Rio Grande do Sul in southern Brazil, whether from the coastal forests or drier inland plains we do not know. It is clear that the group essentially inhabits the hot arid deserts of our southwest, where some of the species are both abundant and conspicuous. Elsewhere they may be counted rare insects.

Our North American species show, with the exception of *pollenifera* Viereck and *octomaculata* Say, a marked antigeny in color. The pattern and appearance of the males, with the former exception, is that of the males of the *plumipes*-group of the subgenus *Campsomeris*, a pattern from which the females have led the way in departing. In *pollenifera* the males have nearly kept pace with their females, in the other species they have been conservative. There is a greater tendency to redness amongst the males than in those of the *plumipes*-group, reaching a climax in

specimens from the Colorado Desert, and the vestiture and tibial spurs do not always maintain the sharp contrasting white color of the *plumipes*-group.

I have studied but few of the Old World species of *Trielis*, but it is clear that at least some of these agree with our species in the very character in which, apart from wing venation, the bulk of our species differ most markedly from *Campsomeris*, namely in the tendency to have clavate antennae.

The author will be pleased, in so far as time permits, to receive specimens for determination of any of the subgenera of Scoliidae from any region of the world.

I am indebted to the authorities of the following institutions and to the individuals mentioned for the loan of material that has made possible this study: The American Museum of Natural History (Dr. Lutz and Mr. Schwarz); The American Entomological Society (Messrs. M. Hebard and E. T. Cresson, Jr.); the Museum of the Brooklyn Institute of Arts and Sciences (Mr. Carl Schaeffer); the Museum of Comparative Zoology (Mr. Banks); the Hungarian National Museum at Budapest (Dr. Szabo-Patay); the Naturhistorische Staatsmuseum of Wien (Dr. F. Maidl); the Bishop Museum of Honolulu (Mr. E. H. Bryan); the Service Tecnique of Haiti (Dr. G. N. Wolcott); the Insular Experiment Station of Porto Rico (Mr. F. Sein, Jr.); Pomona College (Dr. W. A. Hilton); the Field Museum (Dr. Davies and Mr. W. J. Gerhard); the Los Angeles Museum (Mr. L. A. Muchmore); the North Carolina Department of Agriculture at Raleigh (Mr. S. C. Brimley); the Ohio State University, Dept. of Entomology (Dr. Kennedy); the Illinois State Laboratory of Natural History (Dr. Theodore Frison); the University of Minnesota, Dept. of Entomology (Dr. C. E. Mickel); the Mississippi Agricultural Experiment Station (Prof. R. W. Harned and Dr. M. R. Smith); the University of Kansas, Dept. of Entomology (Prof. H. B. Hungerford); the Kansas State Agricultural College (Mr. R. H. Painter); the Mass. Agricultural College (Prof. H. T. Fernald); the University of Arizona, Dept. of Entomology (Mr. A. A. Nichol); the Agricultural College of South Dakota, Dept. of Entomology (Prof. H. H. Severin); Dr. Joseph Bequaert, Prof. C. T. Brues; Prof. P. H. Timberlake, Prof. E. O. Stevens; Mr. S. Graenicher, Dr. Wm. S. Marshall. Part of the

material was obtained on a collecting expedition in 1927, supported by a grant from the Heckscher Research Foundation of Cornell University.

A Key to the American species of Trielis.

FEMALES.

A. Color not entirely black, North American species.

B. Area between the antennae not noticeably elevated above the level of the rest of the front of face; longer hind tibial spur spatulate; hypopygium with an acute flat tooth at each extreme side.

C. Scutellum with no trace of a median sulcus. First tergite yellow fasciate or bimaculate....*octomaculata* (Say)

D. Small species with black tegulae and legs and no rufous Southeastern.
octomaculata race *hermione* (Banks)

DD. At least the apical half of the tegulae and the legs rufous. Specimens from south of Minnesota have at least the head, and often the entire ground color, rufous. Great Plains and the Southwest.

E. Ground color of abdomen fuscous except basally, thorax often and head sometimes with ground color black; abdomen with dark inconspicuous tergal fringes. Usually 23-25 mm. in length. Minnesota to Kansas.....*octomaculata* race *octomaculata* (Say)

EE. Ground color of abdomen, thorax and head rufous, but the thorax black in northern individuals. Tergal fringes conspicuous, coppery or fulvous. Individuals usually small, 18-20 mm. long. Texas and Kansas to southern California.
octomaculata race *texensis* (Saussure)

CC. Scutellum divided by a median sulcus.

D. Second submarginal cell petiolate (i. e. the radial crossvein attached apicad of R5); propodeum above subcarinate; clypeus subtrilobate; humeri, postscutellum and two spots on first tergite yellow.
xantiana (Saussure)

DD. Second submarginal cell not petiolate above (i. e. the radial cross-vein joining radius opposite or basad of R5); propodeum not subcarinate above; clypeus with median lobe emarginate (except in worn individuals); head, antennae, thorax and first abdominal segment entirely black.....*pollenifera* (Viereck)

BB. A strongly elevated platform between the antennae, its surface rugosely punctured; larger hind tibial spur very slightly widened apically not or scarcely spatulate, the hypopygium at each extreme side with a small rounded lobe, or simply undulate. Conspicuously tomentose.

C. Hypopygium with only indistinct lateral undulation; ferruginous or red, with yellow markings, and fulvous or often scarlet vestiture; first tergite fasciate; third submarginal cell always present, four sided, narrowed caudad, but wider there than twice the width of the veins.
flammicoma n. sp.

CC. Hypopygium with a distinct but small rounded lobe on each side; black with legs beyond the coxae ferruginous, tergites with yellow spots, the first immaculate or with two yellow dots; third submarginal cell variable, sometimes absent or stalked in the wing of one side, the second and third cubital veins (R5 and R4) meet behind or are separated not more than about twice the width of one of the veins (in specimens examined.) *alcione* (Banks)

AA. Color of the male entirely black (the female is unknown). South American species.....*lugens* (Kirby)

MALES.

A. Color not entirely black. North American species.

B. Scutellum without a median sulcus.

C. Flagellum quite heavily and rather evenly thickened including to some extent, its basal part (fig. 22). Great Plains and southwest.....*octomaculata* (Say)

D. Legs black and yellow. Southeastern form.
octomaculata race *hermione* (Banks)

DD. Legs red and yellow.
octomaculata race *octomaculata* (Say)
and *octomaculata* race *texensis* (Saussure)

CC. Antennae clavate, obviously thickened toward the apex (figs. 13, 17).

D. An oval, punctured, hairy yellow area at the base of each antennae on the inner side; scape yellow; mesopleura always with a large yellow spot; ground color of head black, of thorax black or reddish, of abdomen red, shading into black toward the apex; legs red, striped and marked with yellow; propodeum largely yellow;

lower hind tibial spur blunt, straight. Southwestern species.....*flammicoma* n. sp.

DD. Hairy punctured areas between antennae fused and black; scape black; mesopleura black, or sometimes with a small yellow spot; ground color black; propodeum black, or with a median yellow spot; legs black and yellow or red, the front tibia with a yellow stripe above. Northwestern species.....*alcione* (Banks).

BB. Scutellum divided by a median channel. Black, marked with deep yellow, the legs sometimes and the abdomen always shading to ferruginous red toward the apex; second tergite with two large spots, the third to fifth with bands, the first immaculate, rarely with two lateral yellow spots. *pollenifera* (Viereck)

AA. Color entirely black; wings ferruginous. South American.....*lugens* (Kirby)

Distinctions in the male genitalia of the North American Species [2]

	Shape of palette	Base of palette	Row of setae on ventral surface of palette	Apical lobe of volsella
pollenifera	Very slender, much narrowed near base (figure 5)	With only a weakly indicated external shoulder (figure 5)	Forming a rather dense line along both margins, connected basally (figure 5)	Very broad; rounded apically (figure 7)
flammicoma	Stouter and less narrowed near base (figure 10)	No shoulder (figure 10)	A sparse line along inner margin and a dense basal patch (figure 10)	Obtusely pointed (figure 11)
alcione	Same (figure 14)	No shoulder (figure 14)	A sparse line along inner margin and a dense basal patch on outer margin (figure 14)	Rounded at apex (figure 15)
texensis	Same (figure 19)	With a strong external shoulder (figure 19)	A sparse line along inner margin only (figures 18 and 19)	More slender and obtusely pointed at apex (figure 20)

[2] (Terminology that used by Betrem '28.)

Campsomeris (Trielis) octomaculata (Say) (Figs. 18-22)

1823. *Scolia octomaculata* Say, West. Quart. Rep., Cincinnati, II, p. 24. [♀].

I have a large series of these *Trielis* from localities scattered from Minnesota to Texas and westward to southern Colorado and the Colorado Desert in Southern California. The females group themselves into two races which merge in western Kansas. From that region northward the females, typical *octomaculata* are usually much larger insects, have the abdomen always dark except sometimes at base, and the thorax with its ground color usually black. Individuals from the extreme north (Minnesota) have the head and entire body color black, except for yellow markings. All of these individuals have a dark inconspicuous fringe on the tergites. Beginning in Kansas and western Texas and extending to the Colorado River the race *texensis* of Saussure is represented by much smaller individuals, the ground color of which is altogether rufous including the abdomen, except that the thorax of some individuals from Kansas, southern Colorado and northern New Mexico is largely black. This race is particularly characterized by fiery or coppery, or pale fulvous but conspicuous fringe on the tergites. All sorts of variation in the details of coloration occur, and it has been described under several different names.

The males are extremely variable in color. My most eastern specimen is from Illinois. It has no yellow markings, except on tergites two to six. An increase in the breadth of the tergal bands is obvious in more western specimens. Texan specimens very frequently have the first abdominal segment entirely red. A tendency toward replacement of the black with red becomes noticeable in Arizona, and reaches an extreme in my only specimen from the Colorado desert, in which every trace of black has disappeared, and the yellow is very extensive, so that it is a very beautiful insect. Specimens of *flammicoma* from the Colorado desert are similarly colored.

I have not found it possible to distinguish between the forms *octomaculata* and *texensis* in the male sex. One may of course infer from the location from which they come, with which females they should be associated, and in listing them below I have

divided them in that way. The females from Minnesota and one from North Dakota are without rufous except on their legs.

There are no distinctions evidenced in the genitalia of the males of these three forms.

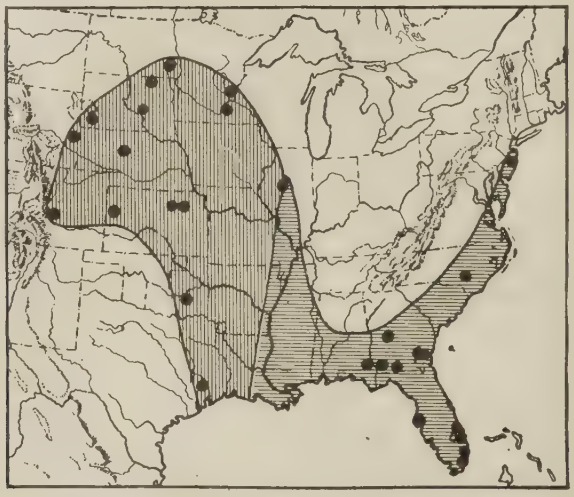


Fig. 1. Distribution of *Campsomeris* (*Trielis*) *octomaculata* (Say). Vertical shading—range of race *octomaculata*. Horizontal shading—range of race *hermione* (Banks).

Campsomeris (Trielis) octomaculata race **octomaculata** (Say)

1823. *Scolia octomaculata* Say, Western Quart. Rep., Cincinnati, II, p. 74. [♀].

1825. *Scolia octomaculata* Say, Amer. Ent. II, pl. 29 and text. Lec. Ed., I, p. 68-69. [♀].

1923. *Trielis alcione* Banks, Canad. Ent. LV, p. 22. [♀].

Specimens examined.—46 females, 36 males.

FEMALES.

MINNESOTA: Anoka Co., Fridley sand dunes, 7 ♀, 8 Aug. '22, (C. Johnson), [Univ. of Minn.]; Scott Co., sand dunes, 2 ♀, 25 Aug. '22, (A. A. Nichol), [Univ. of Minn.].

NORTH DAKOTA: Scott Co., Sheldon, 2 ♀, 10 Aug. '19, on *Kuhnistera villosa*, [O. A. Stevens].

SOUTH DAKOTA: Brown Co., Hecla, 1 ♀, 22 Aug. '24 and Martin, 1 ♀, 29 Aug. '26, (H. C. Severin), [Mus. Comp. Zool.]; Buffalo Co., 1 ♀, 9 Sept. '27, [H. C. Severin].

NEBRASKA: Thomas Co., Halsey, 2 ♀, 15 Aug. '25, (R. W. Dawson), [Univ. Minn.]; 6 ♀, [Amer. Ent. Soc.].

COLORADO: Colorado Springs, 1 ♀, 20 Aug. '22.

KANSAS: Riley Co., 6 ♀, Aug.-Sept., (E. A. Popenoe), [Ks. Agric. Coll.]; Clay Co., 1 ♀, (J. C. Bridwell), [Bishop Mus.]; Wallace Co., 3400 ft. alt. 1 ♀, (F. X. Williams), [Univ. Ks.].

TEXAS: Montgomery Co., Willis, 13 ♀, Je. '03, (J. C. Bridwell), [Bishop Mus.]. Most of the Texas specimens are as small as *texensis*.

MALES PRESUMABLY REPRESENTING RACE OCTOMACULATA.

ILLINOIS: 1 ♂, sand regions, (Hart), [Ill. State Lab. Nat. Hist.].

MINNESOTA: Anoka Co., Fridley sand dunes, 1 ♂, 8 Aug. '24, (Walter Carter), [Univ. Minn.].

SOUTH DAKOTA: Hot Springs, 4 ♂, 11 July '24, [H. S. Severin]; Pierre, 1 ♂, [Amer. Ent. Soc.].

WYOMING: Converse Co., Lusk, (30 miles north of), 4 ♂, July '95, [Univ. Ks.].

KANSAS: Riley Co., 5 ♂, 17 July-5 Aug., (G. A. Dean, E. A. Popenoe), [Ks. Agr. Coll.].

OKLAHOMA: Pittsburg Co., South McAlester, 1 ♂, 11 June, (H. F. Wickham), [Amer. Mus. Nat. Hist.].

TEXAS: Willis, 19 ♂, June '03, (J. C. Bridwell), [Bishop Mus. and Mass. Agr. Coll.].

Distribution.—From Illinois and Minnesota west to Rocky Mountains, south through eastern Kansas (only one record from western) to eastern (humid) Texas.

Campsomeris (Trielis) octomaculata race **texensis** (Saussure)

1858. *Elis texensis* Saussure, Ann. Soc. Ent., France, 1858, p. 224. [♂].
1864. *Elis* (*Trielis*) *texensis* Saussure and Sichel, Cat. Spec. Gen. Scolia, p. 156, (excl. ♀). [♂].
1865. *Scolia regina* Cresson, Proc. Ent. Soc. Phila., IV, p. 447. [♀].
1865. *Scolia flavosignata* Cresson, Proc. Ent. Soc. Phila., IV, p. 449. [♂].
1865. *Scolia consors* Cresson, Proc. Ent. Soc. Phila., IV, p. 449 (*nec.* Saussure) [♂].
1868. *Elis* (*Trielis*) *zonaria* Cresson, Trans. Amer. Ent. Soc., I: p. 378, (new name).
1872. *Elis lupina* Cresson, Trans. Amer. Ent. Soc., IV, p. 202. [♀].

Specimens examined 83 females, 52 males.

FEMALES.

KANSAS: Decatur Co., 2500 ft., 1 ♀, (F. X. Williams), [Univ. Ks.]; Cheyenne Co., 2 ♀, 3300 ft. alt., (F. X. Williams), [Univ. Ks.]; Trego Co., 1 ♀, 2450 ft. alt., 12 July '12, (F. X. Williams), [Univ. Ks.]; Wallace Co.,

3 ♀, July '85, [Ks. Agric. Coll.]; Finney Co., 1 ♀, Sept. '94, (H. W. Menke), [Univ. Ks.]; Hamilton Co., 2 ♀, July, (Hunter), [Univ. Ks. and Brooklyn Mus.]; Grant Co., 5 ♀, 2800 ft. alt., 27 July '11, (F. X. Williams), [Univ. Ks.]; Meade Co., 4 ♀, 2500 ft. alt., 12 July '12, (F. X. Williams), [Univ. Ks.]; Seward Co., 1 ♀, July 1, and 2 ♀, Aug. 16, 2600 ft. alt., (F. X. Williams, [Univ. Ks. and Agric. Coll.]; Morton Co., 1 ♀, 3200 ft. alt., June, (F. H. Snow), [Univ. Ks.].

Colorado: La Junta, 1 ♀, 12 Aug. '20, [Amer. Mus. Nat. Hist.]; Durango 4 ♀, (E. J. Oslar), [Ill. State Lab. N. H.]; Hinsdale Co., Clear Creek, 1 ♀, (E. J. Oslar), [Amer. Ent. Soc.].

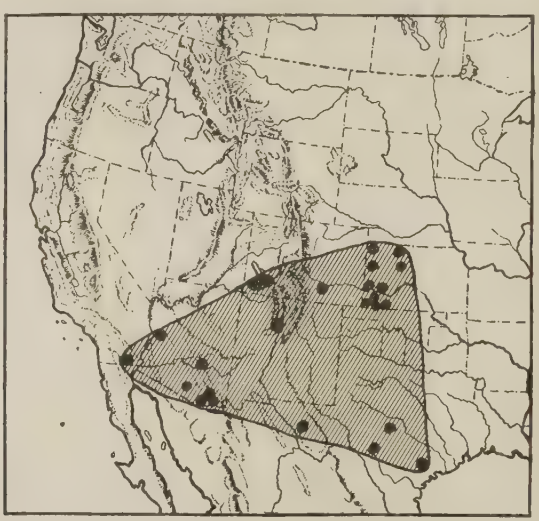


Fig. 2. Distribution of *Campsomeris* (*Trielis*) *octomaculata* race *texensis* (Saussure).

Texas: Mason, 26 Aug. '24, 2 ♀, (R. H. Painter), [Ks. Agr. Coll.]; Karnes Co., Gillette, 1 ♀, 25 Je. '17, (C. U. Exped.), [Cornell U.]; Laguna on the Neuces River, 8 ♀, 2 July '17, visiting *Chilopsis linearis*, (C. U. Exped.), [Cornell U.]; Marfa, 2 ♀, 4600 ft. alt., 516 July, (H. F. Wickham), [Amer. Mus. Nat. Hist.].

New Mexico: Jemez Springs, 4 ♀, 7 July to 1 Aug. '13, (J. Woodgate), [Cornell U.].

Arizona: Huachuca Mts., 1 ♀, [Brooklyn Mus.]; Nogales, 2 ♀, 30 Aug. '27, (the Author), [Cornell U.]; Pima Co., 30 miles east of Quijotoa, 1 ♀, 28-29 Aug. '27, (the Author), [Cornell U.]; Bill William's Fork, 2 ♀, Aug., (F. H. Snow), [Univ. Ks.].

Lower California: 2 ♀, [Amer. Ent. Soc.].

MALES, PRESUMABLY ALL OF RACE TEXENSIS SAUSSURE.

KANSAS: Trego Co., 2455 ft. alt., 1 ♂, 12 July '12, (F. X. Williams), [Univ. Ks.]; Rawlins Co., 2850 ft. alt., 1 ♂, (F. X. Williams), [Univ. Ks.]; Logan Co, 1 ♂, 22 Sept. '25, (H. J. Grady), [Univ. Ks.]; Wallace Co., 1 ♂, July '85, [Univ. Ks.]; Hamilton Co., 1 ♂, July, (J. S. Hunter), [Univ. Ks.]; Grant Co., 2800 ft. alt., 2 ♂, 27 July, (F. X. Williams), [Univ. Ks.].

TEXAS: Karner Co., Gillette, 1 ♂, 25 June '17, (C. U. Exped.) [Cornell U.]; Laguna on the Nueces River, 8 ♂, 2 July '17, visiting *Chilopsis linearis,* (C. U. Exped.), [Cornell U.]; Marfa, 1 ♂, 4800 ft. alt., 5-6 July, (H. F. Wicham), [Amer. Mus. Nat. Hist.]; western part of the state (types of *texensis* Sss.).

COLORADO: Colorado Springs, 1 ♂, 6000-7000 ft. alt., 15-30 Je. '96, (H. F. Wickman), [Amer. Mus. Nat. Hist.], and Drennan Sta., 2 ♂, 17 Aug. '24, [Univ. Minn.]; La Junta, 2 ♂, 12 Aug. '20, [Amer. Mus. Nat. Hist.]; Durango, 4 ♂, [Ill. State Lab. N. H.]; Clear Creek, 1 ♂, (E. J. Oslar), [Mus. Comp. Zool.].

NEW MEXICO: Jemez Springs, 2 ♂, 7 July '13, (J. Woodgate), [Cornell U.].

ARIZONA: Florence, 1 ♂, 18 July, (C. R. Biederman), [Amer. Ent. Soc.]; Huachuca Mts., 1 ♂, [Amer. Ent. Soc.]; Santa Cruz Co., Elgin 1 ♂, 1 Sept. '27, (the Author), [Cornell U.].

CALIFORNIA: Calexico in the Imperial Valley, (Bequaert), [Cornell U.]

LOWER CALIFORNIA: 6 ♂, [Amer. Ent. Soc.].

Distribution.—Upper and Lower Sonoran life zones from western Kansas to the Rocky Mountains in Colorado, and from western Texas to the Imperial Valley in California, and into Lower California.

Campsomeris (Trielis) octomaculata race **hermione** (Banks) (Fig. 18)

1912. *Trielis hermione* Banks can. Ent. XLIV, p. 200. [♂].

1917. *Trielis hermione* Banks Mus. Comp. Zool. Bull. 41, No. 5, p. 112. [♂ ♀].

♀. Black; an angled line beneath each antennae, two vertical oval spots between them, inner orbits, broadly united by a transverse stripe below the ocellus, and nearly united by a stripe across the occiput interrupted medially, posterior orbits, broad oblique bar on shoulders, scutellum, postscutellum, a median and two lateral dots on propodeum (becoming sometimes moderately large spots), subapical broad transverse spots on the first to fourth tergites, united on the fourth, sometimes on the first and third, two dots on the fifth tergite, and a transverse dot on the third sternite, sometimes wanting, pale yellow (buff-yellow in

one, maize-yellow in another individual). Vestiture white, short and inconspicuous except behind head, on propleura, coxae and base of first tergite; the short fine hair of the dorsum in some lights glittering golden, and the appressed scaly pubescence, among the pits of the pygidium coppery-golden; the fringes of the tergites short and inconspicuous, somewhat coppery, those of the sternites two to five long, dense and white. Wings smoky hyaline, with a darker cloud along the costal border before the apex.

Anterior border of clypeus broadly rounded, without lateral notches; the disc with a somewhat raised triangular aciculate area (between the yellow stripes). Sides of clypeus and area between antennae, to the transverse frontal stuture deeply punctate, the latter slightly sinuate, smooth and polished; very sparse punctures on the front above this suture, on the occiput, and posterior part of the vertex; a large almost impunctate area behind the ocelli; scape with very fine punctures.

Pronotum and mesonotum rather closely punctate, the latter sparsely in the centre, but without a differentiated discal area; scutellum with only a few marginal punctures, postscutellum punctate; epicnemial ridges prominent, blunt, not ending in a superior tubercle, their anterior surfaces closely punctate and hairy; dividing suture of the mesopleura obsolete; the dividing carina of the metapleura not extended onto the lateral ridge of the propodeum; metapleura smooth and polished; dorsal surface of propodeum rounding almost immediately into the posterior, the former rather abundantly punctate, the latter inpunctate or very sparsely punctate. Longer hind tibial spur strongly spatulate. Second submarginal cell triangular, sometimes petiolate; marginal cell short, without an appendage.

♂. The hind tibial spurs white, the longer nearly straight and acute, .52 the length of the metatarsus. There may be a short yellow line on both inner and outer orbits and the stripe on each shoulder may be broken; the tergal stripes are sinuate, and the second and third as well as the first, may be interrupted medially. Otherwise my specimens do not differ from Bank's description.

This race preserves more closely than does any other *Trielis* what I believe to be the primitive Scoliid color pattern—a pattern shared by *Campsomeris* (*Campsomeris*) *plumipes* and the less modified members of its species group, and also by other genera of vespid wasps such as *Elis*. In fact *C. hermione* at casual glance looks exceedingly like certain species of *Elis* [=*Myzine*].

Considerable variation occurs in the amount of yellow on the head and thorax of the female, from the ornate form described above, to all black except two dots on the pronotum and a stripe on the postscutellum; the abdominal marks are more usually all separated into eight spots in the females, but all connected into sinuate bands in the male.

Material examined.—26 females, 28 males.

ILLINOIS: ♂, Aug. '99, [C. T. Brues]; Meredosia, 2 ♀, 16 Aug. '99, [C. T. Brues].

NEW JERSEY: Toms River, 1 ♀, [Amer. Mus. Nat. Hist.]; Ocean Co., 8 ♀, Beach Haven, 2 ♀, ♂, 20 Aug. '24, (J. B. Cronin), [Jap. Beetle Lab.].

NORTH CAROLINA: Southern Pines, 3 ♂, 25 Je. '09, (holotype and 2 paratypes), [M. C. Z.]; 4 ♀, 21 ♂, 22 May, 13-14 June, 22 July, (A. H. Manee), [Amer. Mus. Nat. Hist.].

GEORGIA: Oglethorpe, 1 ♀, 1 July '10, (the Author), [Cornell U.]; Waynesville, 1 ♀, 10 Sept. '09, (the Author), [Cornell U.]; Deenwood, Waycross, 1 ♀, 16-18 July '16, [Amer. Mus. Nat. Hist.]; Thomasville, 5 ♀, 22-26 July '16, [Amer. Mus. Nat. Hist.]; Bainbridge, 2 ♂, 15-17 July '09, (the Author), [Cornell U.]; between Climax and Bainbridge, 2 ♀, 28 July '16, [Amer. Mus. Nat. Hist.].

FLORIDA: Pinellas Co., Gulfport, 1 ♀, Sept., (allotype), [M. C. Z.]; Martin Co., Stuart, 1 ♀, 18 Sept. '27, [S. Graenicher]; Palm Beach, 1 ♀, 5 Sept. '27, [S. Graenicher]; S. Miami, 26 Oct. '27, [S. Graenicher]; Broward Co., Hollywood, 1 ♂, 6 Je. '27, [S. Graenicher].

ALABAMA: Houston Co., Cowarts, 1 ♂, 1-3 August '16, [Amer. Mus. Nat. Hist.].

Distribution.—The Austroriparian life zone.

Campsomeris (Trielis) xantiana (Saussure)

1863. *Elis xantiana* Saussure, Ann. Soc. Ent. France, 1863, p. 18. [♀ ♂].
1864. *Elis* (*Trielis*) *xantiana* Saussure and Sichel, Cat. Spec. Gen. Scolia, p. 149, pl. 1, figs. 10-11.

Saussure says "Scutella and . . . sulco partita". There are only two other species with that character; the one is *pollenifera* Viereck, the other is *flammicoma* in which there is a groove rather than deep sulcus in the scutellum, often wanting, but which differs in its frontal tubercle and other ways.

I have seen no specimens that I can regard as this species.

Habitat.—Lower California: Cape San Lucas.

Campsomeris (Trielis) pollenifera (Viereck) (Figs, 5-9)

1906. *Elis* (*Trielis*) *pollenifera* Viereck, Trans. Amer. Ent. Soc., XXXII, p. 191. [♀ ♂].

The longer hind tibial spur of the female is spatulate, but not strongly so. In the male it is white, acute, and strongly curved. The antennae of the male are distinctly clavate, rather evenly thickened from base to just before the apex. In the type specimens from Kansas, the ground color of the apical parts of the legs and abdomen is reddish brown. In specimens from Arizona and Mexico it is red.

There is no significance to the "varieties" described by Viereck. The one is an ordinary male and the characters of the other come within the compass of individual variation, throughout the range of the species.

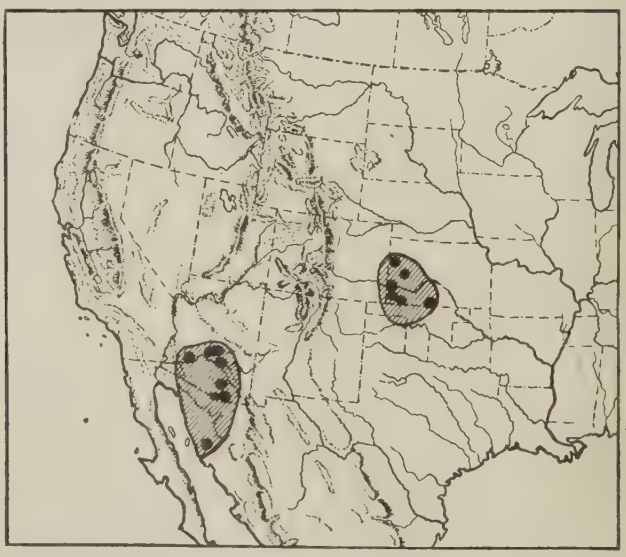


Fig. 3. Distribution of *Campsomeris* (*Trielis*) *pollenifera* (Viereck).

Material examined.—90 females, 57 males.

KANSAS: Barber Co., 3 ♀, 4 ♂, alt. 1468 ft., (R. H. Beamer), [Univ. Ks.]; Scott Co., Scott, 1 ♀, (D. E. Lantz), [Ks. Agric. Coll.]; Seward Co., 1 ♀, 2600 ft. alt., 18 Aug. '11, (F. X. Williams), [Univ. Ks.], 1 ♀, July '21, [Ks. Agric. Coll.]; Wallace Co., 1 ♀, 3400 ft. alt., (F. X. Williams), [Univ. Ks.]; Hamilton Co., 2 ♀, (W. J. Hunter), [Univ. Ks., types]; Grant Co., 1 ♀, 2800 ft. alt., 27 July '12, (F. X. Williams), [Univ. Ks.].

New Mexico: 1 ♀, [Amer. Ent. Soc.].

Arizona: 15 ♀, 8 ♂, Sept., Oct., (Igel), [Vienna Mus.]; Florence, 2 ♂, July, Aug. '03, (Biederman), [Amer. Ent. Soc.]; Tucson, 1 ♀, 8 Oct. '20, and 2 ♀, 1 ♂, 12 July '24, (A. A. Nichol), [Univ. Minn.], 3 ♂, Sept.-Nov. '27, (L. H. Finch; A. O. Knox), [Univ. Ariz.]; Tempe, 2 ♀, 5 ♂, 4 August '17, (the Author), [Cornell U.]; Phoenix, 2 ♀, 2 ♂, 26 Aug. '27, (the Author), [Cornell U.], 6 ♀, 14 Aug. '16, (F. E. Lutz), [Am. Mus. Nat. Hist.]. 1 ♀, 4 ♂, 10-21 July '22, (R. E. Jones and J. H. O'Dell), [Univ. Ariz.]; Wickenberg, 3 ♀, 5 ♂, 25 August '27, visiting flowers of *Cleome lutea* Hooker (the Author), [Cornell U.]; Hassayampa, Maricopa Co., 31 ♀, 7 ♂, 26 August '27, visiting flowers of *Cleome lutea* Hooker, (Hood, Guerlac and Bradley), [Cornell U.]; Nogales, 1 ♀, 30 August '27, (the Author), [Cornell U.]; Pajarito Mts., Nogales, 1 ♂, 31 Aug. '27, (J. D. Hood), [Cornell U.].

Mexico, Sonora: Hermosillo, 2 ♀, 6 ♂, 1 Sept. '08, (J. E. Coit), [Cornell U.].

Distribution.—Western (arid) Kansas to southern Arizona and Sonora.

Types.—Holotype ♀, allotype ♂, paratype ♀, in the collection of the University of Kansas.

Campsomeris (Trielis) flammicoma n. sp. (Figs. 10-13)

♀. Ferruginous (burnt sienna); abdomen with a basal band and six yellow spots. Wings hyaline, yellow along the costal border and deeply violaceous-fuscous toward the apex. Vestiture scarlet or yellow, long and dense behind head, on shoulders, pleura, thorax beneath legs, dorsum and sides of the propodeum, first tergite basally, and the abdominal fringes. Length, 16 mm.

The only yellow on head or thorax is a median dot at the apex of the dorsal surface of the propodeum, and two lateral spots shading into ferruginous. The yellow coloring is not increased in the paratypes, except that the shoulders sometimes become tinged with it. The venter is always immaculate. The vestiture varies from (brazil red) in the type to (pale orange yellow) perhaps by fading or discoloration, but is usually of an intermediate tone.

Clypeus trilobed, its disc rugulose, a rugose raised disc between the antennae, divided by a weak median furrow and bounded laterally by the frontal carinae; front punctured, rugose; vertex very sparsely punctate, polished; occiput above occipital carina finely densely punctate.

Mesonotum moderately punctate with a broadly U-shaped median impunctate area; scutellum with only a few marginal punctures, with an incomplete median groove, much less than the deep channel of pollenifera, often entirely wanting; postscutellum punctate except the very middle; epicnemial ridge prominent but blunt, its anterior surface densely punctate and hirsute; no mesopleural tubercle; sternum with a fine median carinula, its surface with few punctures, its hind margins not reflexed; dorsal surface of propodeum quite short, medially with a suggestion of a tubercle, closely densely punctate, lateral angles rounded, posterior face impunctate. Longer tibial spur only very slightly widened toward the tip. Marginal cell short, with an appendage, third submarginal four-sided (rarely three-sided), these conditions constant in the paratypes.

♂. Black or rufous, with liberal yellow markings, including clypeus, scape, shoulders, scutellums, propodeum and abdominal segments except the bases. Antennae clavate (fig. 13). Wings hyaline, apex infuscated, veins piceous, the costa and Sc+R+M are ferruginous to the end of the stigma, with yellow stains along them on the membrane. Conspicuously white pubescent, the sides of the thorax with appressed pubescence and silvery sheen, the hair white except on the last abdominal segment, where it is black and bristly above, brown beneath. Length, 17 mm.

The ground color of the abdomen is red, usually infuscated or black toward the apex, of the legs always red, of the head and thorax black, but sometimes mostly red on the thorax, and the front is rarely red. The following are yellow (light orange yellow): scape in front, clypeus, front, an oval slightly raised closely punctate hairy spot at base of each antenna, emarginations of the eyes, line on posterior orbits, raised line along the anterolateral borders of the pronotum, broad bar on shoulders, most of mesopleura, scutellum, postscutellum, dorsal surface of propodeum except at base on each side, posterior and lateral faces, spot on front and hind coxae, apex of front femora, outer surface of middle and hind femora, upper surface of all tibiae and tarsi, dorsum of first tergite, tergites two, three and four except at base, and a medially notched broad band on fifth and sixth tergites and on all but first and last sternites.

Hind tibial spurs ferruginous, the longer one straight, acute, .5 the length of the metatarsus. The marginal cell is usually about twice the length of the third submarginal, sometimes less, usually truncate, sometimes rounded, usually without an appendage, sometimes with; the third submarginal is four-sided, but R4 and R5 are rarely approximate below, it is never wanting or stalked.

Genitalia as shown on the plate (figs. 10-12).

This species is very closely related to *alcione* Banks.

Material examined.—53 females; 42 males.

NEW MEXICO: Las Cruces, 1 ♀, 21 May, [Amer. Ent. Soc.].

ARIZONA: 2 ♂, Oct., (Igel), [Vienna Mus.]; Tucson, 1 ♀, 14-17 Aug. '16, (F. E. Lutz), [Amer. Mus. Nat. Hist.]; Florence, 1 ♀, 1 ♂, 28 July '17, (Cornell U. Biol. Exped.), [Coll. J. Bequaert]; 4 ♀, 8 ♂, 23 Je., (C. R. Biederman), [Amer. Ent. Soc.]; Tempe, 1 ♀, 4 Aug. '17, (the Author); Phoenix, 3 ♂, 3 Aug. '17, (Cornell U. Biol. Exp.), [Cornell U.]. Papago Indian Reservation, east of Ajo, 2 ♂, 1 ♀, 27 August '27, [the Author]; Hassayampa, 5 ♀, 26 Aug. '27 on flowers of *Cleome lutea* Hooker, [J. D. Hood, H. E. Guerlac and the Author]; Juma Co., 2 ♀, (purchased from Amer. Ent. Co.) and 3 ♀, Sept., [Brooklyn Mus.]; Wellton, 1 ♂, 5-6 May '18, (the Author), [Cornell U.]; Bill Williams Fork, 2 ♀, (F. H. Snow), [Univ. Ks.].

CALIFORNIA: In low desert 25 miles west of Blythe, 2 ♀, 6 ♂, 18-19 Aug. '27, (the Author, includes holotype and allotype); Imperial Valley, Calexico, 2 ♂, 16 Aug., and Holtville, 1 ♀, 2 ♂, 11 Aug. '17, (C. U. Biol. Exped.), [Col. J. Bequaert]; Imperial Co., Exper. Farm, 4 ♀, 3 ♂, June, (J. C. Bridwell), [Bishop Museum].

MEXICO, Sonora: Hermosillo, 21 ♀, 11 ♂, 1 Sept. '08, [Dr. J. E. Coit].

Distribution.—Lower Sonoran life zone from southern Arizona and Sonora to southeastern California.

As will be seen both this species and *pollenifera* Viereck range from central Sonora into southern Arizona. The latter occurs also in Kansas, but does not seem to reach the western part of the state of Arizona, at least not in sufficient numbers for me to have observed it in what collecting I have done there. The type locality of *flammicoma* is only a short distance west of the Colorado River and is a district perhaps more closely allied to western Arizona than to that of the Imperial Valley or Colorado Desert to the south and west. West of the San Gorgonio Pass and northward, in the San Joaquim Valley, this species is completely replaced by *alcione* Banks, the type locality of which is Washington.

Type.—♀; Twenty-five miles west of Blythe, California, 18-19 August, 1927, (J. C. Bradley), [Cornell University, no. 100.1].

Allotype.—♂; topotypical, [Cornell University, no. 100.2].

Paratypes.—93 specimens contained in the material examined.

Campsomeris (Trielis) alcione (Banks) (Figs. 14-17)

1917. *Trielis alcione* Banks, Bull. Mus. Comp. Zool. XLI, p. 112. [♂].
(1923. *Trielis alcione* Banks, Can. Ent. LV, p. 22 [♀] is *octomaculata* Say, q. v.)

♀. Black, with strongly maculate abdomen and red legs and face. Wings ferruginous with violaceous reflection. Hair shaggy. Length, 14-21 mm.

Head and thorax black, immaculate, except the mandibles, face, antennal tubercles, scape in front, and legs are ferruginous (bay). Abdomen black above, the venter red, black at apex, or sometimes nearly all infuscated; there are two large lemon yellow (empire yellow) spots on each side of tergites two, three and four, and sometimes inconspicuous spots on the fifth usually hidden by vestiture; the first tergite is usually immaculate, sometimes has two small round spots; venter immaculate. The face, head behind, propleura, band across shoulders and front of mesonotum, epicnemial ridge, sternum, sides of postscutellum and dorsum of propodeum, especially at the lateral angles, and first dorsal segment have rather dense, buff (light orange yellow) pubescence, which together with the very long and dense fringes on the abdomnal segments give the insect a characteristic shaggy appearance.

Anterior margin of clypeus rounded, very slightly sinuate, disc scabrous; two raised and flattened tubercles at bases of antennae, with rugose-punctate surfaces, separated from one another by a margined groove; frontal suture straight, impunctate and polished, overhung by obscuring vestiture; few large punctures on the front; vertex and occiput almost impunctate, polished; punctation of shoulders obscured by vestiture; mesonotum punctate only around the edges, the disc noticeably convex, smooth, polished, and impunctate; scutellum with a very few marginal punctures; postscutellum and dorsal surface of propodeum moderately punctate, posterior surface with central part impunctate, polished, lateral areas sparsely punctulate; a suggestion of a tubercle at apex of dorsal surface; epicnemial ridges prominent but broadly rounded throughout, densely punctate; the dividing mesopleural suture almost obsolete, entirely so in front; dividing carina of metapleura continued to near the posterior angles of the propodeum; posterior surface of propodeum almost flat. Hind tibial spurs not spatulate, of almost equal width throughout. Marginal cell short, with a long appendage; third submarginal remarkably variable, sometimes four-sided, narrowed below, sometimes triangular, sometimes petiolate on one wing and in two individuals altogether lacking in the wing of one side.

This is the only *Trielis* known from west of the San Gorgonia Pass and north of the Cajon. It seems to belong more properly to the upper than lower Austral faunal zone.

The female described by Banks [3] as of *alcione* is a female of *octomaculata*.

Both males and females are strikingly variable in the shape and even presence of the third submarginal cell, a character not shared, so far as I have observed, with other species, at least not to so marked a degree.

Material examined.—43 females, 41 males.

WASHINGTON: Lone Tree[4] ♂, 18 July '82, (type); Big Bend[4] ♂, 19 July '82, (paratype); Ainsworth, ♂, 20 July '82 (paratype).

COLORADO: Mesa Co., Palisade, 1 ♀, 5 ♂, 18 July '17, 4740 ft. alt., [Amer. Mus. Nat. Hist.]; Glenwood Springs, 1 ♂, 5 August '20, 5800 ft. alt., [Amer. Mus. Nat. Hist.].

NEW MEXICO: Rincon, 2 ♂, 5 July, (T. D. A. Cockerell; at flower of mesquite, *Prosopis glandulosa*), [Amer. Ent. Soc.].

UTAH: Inab Co., Trout Creek, Ibapah Mts., 15 ♀ 13 ♂, 4, 9, 14 July, 16 Aug. '22, (Tom Spaulding), [Amer. Mus. Nat. Hist.]; Smelter 2 ♀, 18 July '09, (E. S. G. Titus), [M. C. Z.].

CALIFORNIA: Tulare Co., Lemoncove, 6 ♂, 9-11 July '07, 500 ft. alt., (the Author), [Cornell U.]; Porterville, 2 ♀, 2 July '25, (Craig), [Pomona Coll.]; Claremont 3 ♀, 1 ♂, (C. F. Baker), [Cornell U. and Pomona Coll.]; Puento Hills, Whittier, 3 ♂, 17 Aug. '20, at flowers of Philibertella, (C. H. Timberlake); Fullerton, 1 ♀, 5 Aug. '17, on flowers in dry stream bed, (E. Osterhout), [Cornell U.]; Pasadena, 1 ♀ [Cornell U.]; Whittier, 3 ♂, 17 Aug. '20, at Philibertella, [P. H. Timberlake]; Riverside, 6 ♀, 1 ♂, 5-10 July, 3-6 Aug. '25 on *Eriogonum fasciculatum*, [P. H. Timberlake]; San Jacinto Mts., 3 ♀, 14 July '12, (J. C. Bridwell), [Bishop Museum]; Lone Pine, Owens Valley, 2 ♀, 3 ♂, 10 Aug. '12, (J. C. Bridwell), [Bishop Museum].

NEVADA: 5 ♀, 4 ♂, [Amer. Ent. Soc.].

Distribution.—Upper Sonora life zone from the Rocky Mountains to the Pacific Coast.

[3] Can. Ent. 1923, LV, p. 22.

[4] These localities are on the Yakima River in Central Washington. I find no Ainsworth, but South Ainsworth is at the junction of the Snake with the Columbia, a little below the mouth of the Yakima. At any rate they are clearly all from the arid interior of eastern Yakima Co., southern Franklin or western Walla Walla Co.

Type.—♂ ; [Museum of Comparative Zoology, no. 10,027].
Paratypes.—2 ♂ ; [Mus. Comp. Zool.].
Allotype.—♀ ; Fullerton, California, 5 August, 1917, (E. Osterhout; on flowers in dry stream bed), [Cornell University, no. 848].

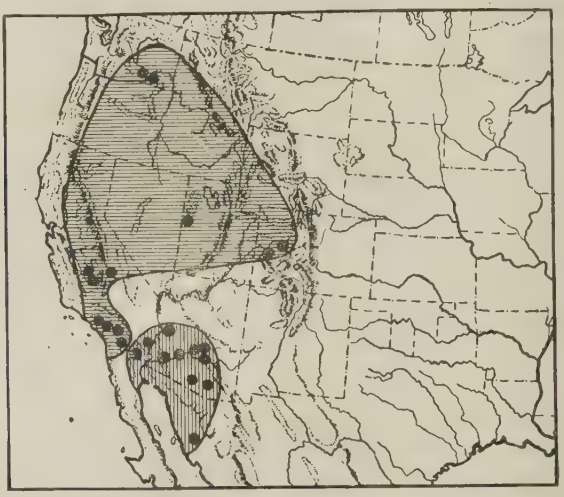


Fig. 4. Distribution of *Campsomeris* (*Trielis*) *alcione* (Banks) and *flammicoma* new species. Vertical shading—range of *flammicoma*. Horizontal shading—range of *alcione*.

Campsomeris (Trielis) lugens (Kirby)

1889. *Elis lugens* Kirby, Trans. Ent. Soc. Lond., 1889, p. 450., pl. 15, fig. 8. [♂].

I have not seen this all black species, known from the unique type, and which probably is not very closely allied to our North American forms. Described from Rio Grande do Sul, Brazil.

Explanation of Plate xxii

Campsomeris (*Trielis*) *pollenifera* (Viereck)

Fig. 5.—Male genitalia, ventral view, left half.
Fig. 6.—Apex of tibia and metatarsus.
Fig. 7.—Volsella.
Fig. 8.—"Penisklappen".
Fig. 9.—Antenna of male.

Campsomeris (*Trielis*) *flammicoma* new species

Fig. 10.—Male genitalia, ventral view, left half.
Fig. 11.—Volsella.
Fig. 12.—"Penisklappen".
Fig. 13.—Antenna of male.

Campsomeris (*Trielis*) *alcione* (Banks)

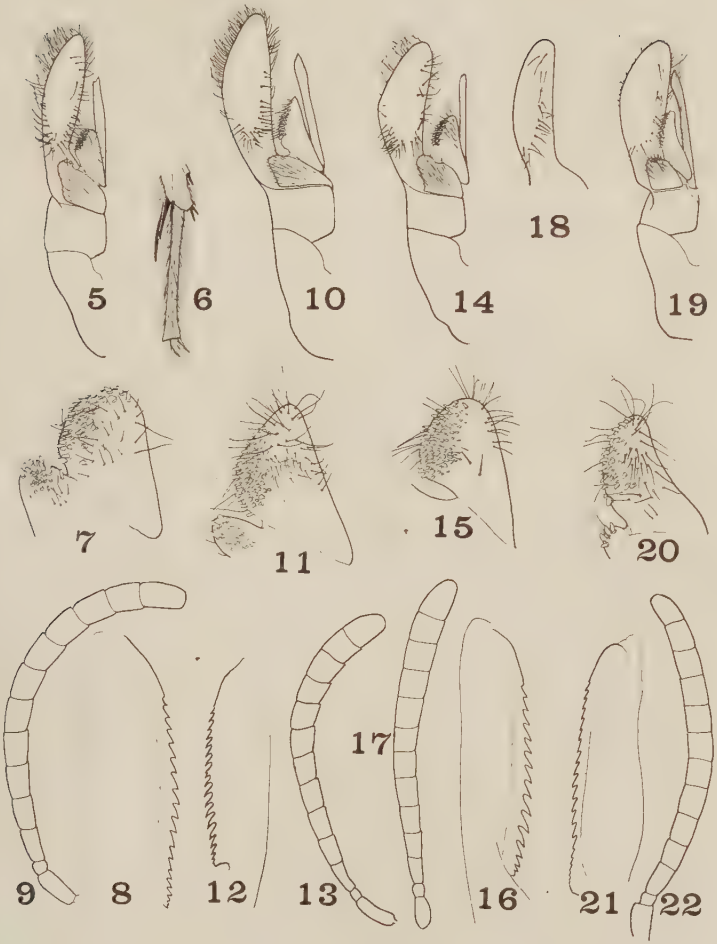
Fig. 14.—Male genitalia, ventral view, left half.
Fig. 15.—Volsella.
Fig. 16.—"Penisklappen".
Fig. 17.—Antenna of male.

Campsomeris (*Trielis*) *octomaculata* race *hermione* (Banks)

Fig. 18.—Palette.

Campsomeris (*Trielis*) *octomaculata* race *texensis* (Saussure)

Fig. 19.—Male genitalia, ventral view, left half.
Fig. 20.—Volsella.
Fig. 21.—"Penisklappen".
Fig. 22.—Antenna of male.



BRADLEY—AMERICAN TRIELIS (HYMENOPTERA)

A LIST OF THE SPECIES AND DESCRIPTIONS OF NEW FORMS OF THE AMERICAN GENUS ZALE AND A NEW FORM OF SAFIA

(LEPIDOPTERA: NOCTUIDAE, CATOCALINAE)

BY FRANK HAIMBACH

The reception about a year ago of a large number of Heterocera collected at light and bait by Mr. Wm. S. Blatchley, at Dunedin and Royal Palm Park, Florida, among which were over one hundred specimens of the genus *Zale*, was the incentive for this study. Among these specimens were a number which also occur in the Neotropical subregion, these I sent to Mr. William Schaus of the National Museum, who kindly determined them for me. On this occasion I wish again to express my gratitude to him. Mr. Frank Morton Jones of Wilmington, Delaware, kindly placed his collection of this genus at my disposal for study, for which favor I wish here to thank him. For the examination of the John B. Smith types, now contained in the Rutgers College Collection, I have made several trips to that institution, for which privilege my thanks are due to Dr. Thomas J. Headlee, as well as to Mr. Carl Ilg of the same institution, who rendered me every assistance. Finally my sincere thanks are due to Mr. Roswell C. Williams, Jr., for the preparation of the genitalic slides which will be referred to in this study.

The material in the Academy contains specimens collected on various expeditions by Messrs. Hebard and Rehn, Dr. Henry Skinner, Wm. J. Coxey, Wharton Huber and others, and my own collection, which I am incorporating with that of the Academy. To determine this material and to properly record the result, is the purpose of the study which I have undertaken, and it is intended to study all the material, in groups, in unrestricted sequence, as time permits. The sequence of species in this list, is that employed by Sir George F. Hampson, in the Catalogue

of the Noctuidae in the collection of the British Museum Vol. XIII, 1913, adding such forms which have been subsequently described, and making such revisions as seem pertinent. Unless otherwise stated all the published records are those from specimens contained in the collection of the Academy of Natural Sciences. All types are deposited in the collection of the Acaddemy of Natural Sciences of Philadelphia.

Zale discisigna (Walker)

1857. *Homoptera discisigna* Walker, Cat. Het. Br. Mus., XIII, p. 1066. (Honduras.)
1913. *Zale discisigna* Hampson, Cat. Noct. Br. Mus., XIII, p. 208, text fig. 54.
1916. *Zale discisigna* ab. *discisignata* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 43.

Record: 1 ♂, without data.

Zale setipes (Gueneé)

1852. *Xylis setipes* Gueneé, Spec. Gen. Noct., III, p. 7, pl. 15, fig. 6. (Brazil.)
1852. *Homoptera peruncta* Gueneé, Spec. Gen. Noct., III, p. 9.
1857. *Homoptera ustipennis* Walker, Cat. Het. Br. Mus., XIII, p. 1071.
1858. *Letis incipiens* Walker, Cat. Het. Br. Mus., XIV, p. 1266.
1880. *Homoptera aemona* Druce, Biol. Cent. Amer., Het., I, p. 344, pl. 31, fig. 3.
1913. *Zale setipes* Hampson, Cat. Noct. Br. Mus., XIII, p. 209, text fig. 55.
1916. *Zale setipes* ab ♀ *postmedialis* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 43.

Record: CUBA: (Poey Coll., No. 906), [1 ♂, 1 ♀].

Zale exhausta (Gueneé)

1852. *Homoptera exhausta* Gueneé, Spec. Gen. Noct., III, p. 14. Brazil, No. Amer.)
1858. *Homoptera vernifera* Walker, Cat. Het. Br. Mus., XV, p. 1798.
1865. *Homoptera privata* Walker, Cat. Het. Br. Mus., XXXIII, p. 883.
1908. *Phaeocyma exhausta* Smith, Proc. U. S. Nat. Mus., XXXV, p. 221.
1913. *Zale exhausta* Hampson, Cat. Noct., Br. Mus., XIII, p. 213, pl. 228, figs. 19, 20.

Record: FLORIDA: Royal Palm Park, Apl. 16, 1927, (Blatchley), [1 ♂].

Zale pachystrigata Hampson

1913. *Zale pachystrigata* Hampson, Cat. Noct. Br. Mus., XIII, p. 214, pl. 229, figs. 1, 2. (Mexico, Guatemala.)

Zale galactea Hampson

1913. *Zale galactea* Hampson, Cat. Noct. Br. Mus., XIII, p. 215, pl. 229, fig. 3. (Mexico, Panama.)

Zale viridans (Gueneé)

1852. *Homoptera viridans* Gueneé, Spec. Gen. Noct., III, p. 13. (Brazil.)
1858. *Homoptera viridisquama* Walker, Cat. Het. Br. Mus., XV, p. 1797.
1908. *Phaeocyma viridans* Smith, Proc. U. S. Nat. Mus., XXXV, p. 224. (Florida.)
1913. *Zale viridans* Hampson, Cat. Noct. Br. Mus., XIII, p. 215, pl. 229, fig. 4.

Records.—FLORIDA: Royal Palm Park, Mch. 29 to Apl. 13, 1927, (Blatchley), [8 spms.]. CUBA: (Poey Coll. No. 510, as *Homoptera obsita* Gn.), [2 ♂, 1 ♀]. COLOMBIA: Vista Nieva, near Santa Marta Mts., Oct. 4-31, 1926, [2 spms.]. MEXICO: [1 spm.]. [Two specimens without data.]

Zale meridiana new species

Alar expanse 54 mm. Head and thoroax red brown mixed with grey, patagia mixed with black throughout, collar with a black line; abdomen light ochre, very slightly tufted, and the last two segments distinctly ringed with black. Primaries ochre, with an olive appearance, produced by golden green scales indiscriminately scattered over them; the basal area suffused with dark brown, reniform yellowish within a suffused large brown blotch toward costa, another such blotch in the median area, and another somewhat larger blotch along costa, but not to apex.

The t.a. line blackish, indistinctly defined, t.p. line black, dentate, from base to 1st radial, s.t. line geminate, outwardly bent at middle, and filled in with green scales, the lower more conspicuously so than the upper half. Secondaries of the same color as primaries. An extra median double line, the outer one the heavier, the inner ending about 1/3 from termen, this double line beneath with dark-brown suffusion below which are golden green scales, the whole forming a nearly straight band across wing; below this band is a light space less than 3 mm. wide. (In viridans this space is 6 mm. wide at center), above this band are light, but well defined strigilations to apex; all wings have small red-brown marginal dots. Beneath wings are light-ochre with a suffused dark-brown marginal band, inside of which is a fine brown line, distinct discal spots, and fine strigilations except at base, the lower wings being more heavily marked than the upper.

Nearest to *viridans* in superficial appearance.

Type.—♀; Naranjapata, Ecuador, 1850 ft. alt., November, 1926, collected by W. J. Coxey, [A. N. S. No. 7264].

Zale fictilis (Gueneé)

1852. *Homoptera fictilis* Gueneé, Spec. Gen. Noct., III, p. 10. (Cayenne?)
1852. *Homoptera guadulpennis* Gueneé, Spec. Gen. Noct., III, p. 10.
1852. *Homoptera strigimacula* Gueneé, Spec. Gen. Noct., III, p. 11.
1857. *Homoptera gradata* Walker, Cat. Het. Br. Mus., XIII, p. 1060.
1908. *Phaeocyma fictilis* Smith, Proc. U. S. Nat. Mus., XXXV, p. 222. (Texas, Florida.)
1913. *Zale fictilis* Hampson, Cat. Noct. Br. Mus., XIII, p. 216, pl. 229, fig. 5.

Records.—FLORIDA: (Johnson), [1 spm.]. COSTA RICA: Guápiles, 964-1000 ft., VIII, 12-25, 1923, at light, (Rehn), [3 spms.].

Zale terrosa (Gueneé)

1852. *Homoptera terrosa* Gueneé, Spec. Gen. Noct., III, p. 11. (Guadeloupe, Mexico.)
1913. *Zale terrosa* Hampson, Cat. Noct. Br. Mus., XIII, p. 217, pl. 229, fig. 6.

Records.—JAMAICA: Mona Great-House, near Hope Gardens, 550-600 ft., VIII, 3-4, 1923, at light, 1 spm., (Rehn). TRINIDAD: Maraval, (Buthn), [1 spm.].

Zale grata Dognin

1912. *Zale grata* Dognin, Het. Nouv. Am. Sud, VI, p. 13. (Colombia.)
1913. *Zale grata* Hampson, Cat. Noct. Br. Mus., XIII, p. 218, pl. 229, fig. 7.

Zale sabena (Schaus)

1901. *Homoptera sabena* Schaus, Ann. Mag. Nat. Hist., (7), VIII, p. 42. (Mexico.)
1913. *Zale sabena* Hampson, Cat. Noct. Br. Mus., XIII, p. 219, pl. 229, fig. 8.
1926. *Zale sabena* Barnes and Benjamin, Proc. Ent. Soc. Wash., XXVIII, p. 19. (Arizona.)

Zale configurata (Walker)

1857. *Homoptera configurata* Walker, Cat. Het. Br. Mus., XIII, p. 1058. (Mexico.)
1913. *Zale configurata* Hampson, Cat. Noct. Br. Mus., XIII, p. 219, pl. 229, fig. 9.

Zale fuliginosa (Walker)

1857. *Homoptera fuliginosa* Walker, Cat. Het. Br. Mus., XIII, p. 1059. (St. Domingo.)
1913. *Zale fuliginosa* Hampson, Cat. Noct., Br. Mus., XIII, p. 220, pl. 229. fig. 10.

Zale rufosa Hampson

1913. *Zale rufosa* Hampson, Cat. Noct., Br. Mus., XIII, p. 221, pl. 229. fig. 11. (Jamaica.)

Record.—JAMAICA: Pleasant Hill, 3700-3750 ft. alt., Blue Mts., VII, 24, 1923, (Rehn), [1 spm.].

Zale posterior (Walker)

1857. *Homoptera posterior* Walker, Cat. Het., Br. Mus., XIII, p. 1060. (Jamaica.)

1913. *Homoptera posterior* Hampson, Cat. Noct., Br. Mus., XIII, p. 217. (As synonym of *terrosa.*)

1917. *Zale posterior* Barnes and McDunnough, Check list, p. 82, No. 3172.

Zale sexplagiata (Walker)

1857. *Homoptera sexplagiata* Walker, Cat. Het. Br. Mus., XIII, p. 1064. (Brazil.)

1908. *Homoptera sexplagiata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 272.

1913. *Zale sexplagiata* Hampson, Cat. Noct. Br. Mus., XIII, p. 221, pl. 229, fig. 12.

1916. *Zale sexplagiata* ab. *zana* Strand, Arch. Natg. LXXXII, Abt. A/2, p. 43.

1916. *Zale sexplagiata* ab. *zanata* Strand, Arch. Natg. LXXXII, Abt. A/2, p. 43.

Record.—COSTA RICA: La Palma, 5000 ft., VII, 28, 1927, at night, at light, (Tristan & Rehn), [1 spm.].

Zale salicis (Behr)

1870. *Homoptera salicis* Behr, Trans. Am. Ent. Soc., III, p. 28. (♀, California.)

1870. *Homoptera rosae* Behr, Trans. Am. Ent. Soc., III, p. 28. (♂, California.)

1908. *Phaeocyma salicis* Smith, Proc. U. S. Nat. Mus., XXXV, p. 228.

1913. *Zale salicis* Hampson, Cat. Noct. Br. Mus., XIII, p. 222, pl. 229, fig. 13.

Records.—CALIFORNIA: Guernville, July, 1913, [6 spms.]; Riverside, [1 spm.]; Los Angeles, Aug., 1916, [1 spm.]; Campo, San Diego County, 2400 ft. alt., IX, 13, 1922, (Rehn & Hebard), [1 spm.]; "Calif." [2 spms., without further data].

Zale lunata (Drury)

1770. *Noctua lunata* Drury, Ill. Exot. Ins., I, p. 40, pl. 20, fig. 3. (♀, Carolina, Virginia.)

1773. *Noctua edusa* Drury, Ill. Exot. Ins., II, p. 42, pl. 24, fig. 4. (♂, New York.)

1818. *Noctua fluctuaris* Hübner, Eur. Schmett. Noct., fig. 449.

1829. *Erebus putrescens* Guerin, Icon. R. Anim., p. 522, pl. 89, fig. 3. (larva.)
1865. *Homoptera marginalis* Walker, Cat. Het. Br. Mus., XXXIII, p. 878.
1865. *Homoptera saundersi* Bethune, Proc. Ent. Soc. Phil., IV, p. 215.
1908. *Phaeochyma lunata* Smith, Proc. U. S. Nat. Mus., XXXV. p. 225.
1913. *Zale lunata* Hampson, Cat. Noct. Br. Mus. XIII, p. 223.

Records.—PENNSYLVANIA: More than 200 specimens from following localities: Philadelphia, Dec. 9, 1916, (W. L. Abbott); Philadelphia, July 13, August 7 and 17, Oct. 18, at light, (Haimbach); Lower Merion Township, Montgomery County, July 18, Aug. 30, Oct. 1, Nov. 3, 1916, Nov. 27, 1920, (Haimbach); Elwyn, May 14, 1894, Sept. 17-28, 1895, Sept. 16, 1896, (Wells); Honey Brook, Chester Co., May 29, 1904, (W. W. Climenson). NEW JERSEY: Holly Beach, July 29, 1900, Aug. 20 and 27, 1904, (Haimbach). MARYLAND: Chestertown, Kent County, Aug. 4, 1904, (Vanatta). INDIANA: Marion County, June 20, 1921, Aug. 4, 1923, (Blatchley.) ILLINOIS: Chicago. IOWA: Decorah. TEXAS: No. 2511, (x. Coll. H. Strecker). FLORIDA: Dunedin, Feb. 27, 1922, (Blatchley); Royal Palm Park, March 29 to April 17, 1927, (Blatchley). ARKANSAS: Hope, Aug. 5 and 10, (L. Knobel).

The earliest record of my own collecting for this species is July 13th; the majority of specimens were collected from middle August to end November. There is a specimen in the collection labeled "Elwyn, Pa., May 14th"; I wonder if this is not a case of labels becoming mixed, the specimen is a male, and typical. Smith in his revision [1] writes "*lunata* and *minerea* do not appear at the same time", and I believe this is the case. Mr. C. S. Wells, who is credited on label as collector of the specimen on May 14th, also collected a good series of minerea, at Elwyn. These are in the collection without dates. Some of my proven records are considerably earlier for this species than Smith credits to it.

The variety *saundersi* is taken everywhere that the typical form is found; there is a specimen in the collection (♂) labeled "Compared with type", in A. R. Grote's handwriting. This is the form with the primaries suffused with ochre yellow, different from the Florida specimens which are very dark with a reddish admixture.

[1] Proc. U. S. Nat. Mus. XXXV.

♀ *form* **lunatoides** Strand (Pl. XXIII, fig. 3.)

1916. *Zale lunata* ab *lunatoides* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 43.

The description of ab. *lunatoides* Strand, loc. cit., is very incomplete, referring only to the "ochre-whitish band outside of the postmedian line, excepting in costal field". This agrees with the specimens before me, but there are other differences which may justify another name for the twenty-four specimens before me from Royal Palm Park, Florida. The lower wings are somewhat lighter, and are strigilate from base, while in typical lunata, this strigilation begins about one-third from base. All the specimens are females; six specimens with the narrowest bodies were dissected, and all proved to be females. This leads me to the conclusion that it is a Mendelian female form; a parallel case is that of *umbripennis*, and to a lesser degree that of *coracias*. All the specimens are constant, showing no variation whatever. Until further study they are placed as above. There are two specimens in the collection labelled "Mex." which I associate with this form, although one is much smaller.

Zale phaeograpta Hampson

1913. *Zale phaeograpta* Hampson, Cat. Noct. Br. Mus., XIII, p. 225, pl. 229, fig. 14. (Paraguay.)

Zale plumbeolineata Hampson

1918. *Zale plumbeolineata* Hampson, Nov. Zool., XXV, p. 213. (Jamaica.)

Zale plumbimargo E. A. Prout

1921. *Zale plumbimarga* Prout, Ann. Mag. Nat. Hist., VIII, p. 20, pl. 3, fig. 6. (S. E. Peru; Santo Domingo.)

Zale smithi new species (Pl. XXIII, fig. 4, ♂.)

Alar expanse 45-49 mm. Primaries fawn color; subbasal line very dark, heavy, runs a little over half way from dorsum toward costa; t.a. line dark brown, with two similar lines, outwardly not so clearly defined; t.p. line blackish, very irregular, bent outward near middle, and running to costa about one half from apex, at the end of which is a clear, white, short, irregular line; s.t. line dark, defined outwardly with black, and extending from termen to vein four, forming an ovate line over tornus. Secondaries darker, with a well defined geminate extra-median line, widening toward termen, beneath which is a metallic shade, following which are narrow black disconnected lines; above the

extra-median lines are four more or less well defined strigilations to about one-third from base, and the basal third is filled with small black dots. Beneath: wings are light grey, with fairly distinct striation and discal dots on all wings.

The only difference between the sexes is that in the female the median area of primaries is of a lighter shade.

Type.— ♂ ; Royal Palm Park, Florida, April 13, 1927, [A. N. S., No. 7152]. *Allotype*, same location, April 9, 1927, and 1 ♂, paratype April 18, 1928. All collected by Mr. W. S. Blatchley. 2 ♀, paratypes, in Mr. F. M. Jones' collection. Named in honor of the lamented John B. Smith, whose work in Entomology and especially in the Noctuidae is well known.

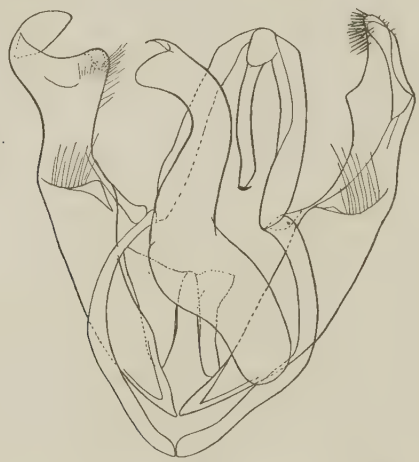


Fig. 1. Male Genitalia of *Zale mithi* new species.

Zale mexicana new species

Alar expanse 43 mm. Head, thorax, abdomen and wings all uniform light fawn color, patagia dark brown mixed with a few grey scales. Distinct black collar, abdominal segments black, wings are all broad and well rounded. Primaries with a broken geminate subbasal line and the t.a. line, with an indistinct line following it outwardly; all these lines are within the basal half of the wing, and the whole has the appearance of a large brown spot, another triangular brown spot along costa to apex, t.p. line very indistinctly evident, running through an ochre suf-

fusion, which runs from center of lower margin to apex. The s.t. line is black, to vein four, and indistinct beyond that to costa, a black terminal line. The tornus has several irregular striggilations and dots outside of the heavy ovate dark marking. The secondaries have the usual double line, filled in with a dark metallic color, and several more or less distinct lines above it, to less than one-third from base, below the double line are two or three broken lines of very dark color. The cilia are crossed by two dark lines. Underside brownish grey with indistinct markings except 3 light brown lines in center of lower wings, which are fairly distinct.

Type.— ♂ ; Mexico. [A. N. S., No. 7153.]

Zale unilineata (Grote)

1876. *Homoptera unilineata* Grote, Can. Ent., VIII, p. 108. (Canada.)
1908. *Phaeocyma unilineata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 245.
1913. *Zale unilineata* Hampson, Cat. Noct. Br. Mus., XIII, p. 226, pl. 229, fig. 15.
1916. *Zale anilineata* ab. *purpureo-brunnea* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 43.

Records.—IOWA: NEW HAMPSHIRE: Hampton, May 27, 1898. [2 spms.]

Zale declarens (Walker)

1857. *Homoptera declarens* Walker, Cat. Br. Mus., XIII, p. 1057. (East Florida.)
1908. *Phaeocyma calycanthata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 269. [nec. Smith and Abbott.]
1913. *Zale declarens* Hampson, Cat. Noct. Br. Mus., XIII, p. 227, pl. 229, fig. 16.

Records.—FLORIDA: Dunedin, March 28, 1920, (Blatchley), [1 spm. determined by Mr. Foster H. Benjamin]; "Florida", (Johnson), [2 spms.]; "Florida", [1 spm.]; Osprey, (W. H. Smith), [1 spm.].

These latter four specimens labeled *Homoptera calycanthata* S. & A. by John B. Smith, who evidently did not know *declarens*, as no mention is made of it in his revision of this genus [2].

The specimen determined for me by Mr. Benjamin fits description precisely, as do the specimens above referred to. In the contrary the four specimens labeled *calycanthata*, do not fit the

[2] Proc. U. S. Nat. Mus., XXXV, 1908.

description by Smith and Abbott, nor the illustrations; the dimensions of figures are 42 mm. ♂ and 50 mm. ♀; Hampson gives 48 and 54 respectively for male and female, and our specimens which are *declarens* and not *calycanthata* measure 33-35 mm.; Walker in his description of *declarens* gives dimensions as 15 lines=32 mm. *Declarens* is a frail insect, while *calycanthata* is a robust one according to figures by Smith and Abbott.

Zale albidula (Walker)

1865. *Homoptera albidula* Walker, Cat. Br. Mus., XXXIII, p. 880. (St. Domingo.)

1913. *Zale albidula* Hampson, Cat. Noct. Br. Mus., XIII, p. 227, pl. 229, fig. 17.

Zale galbanata (Morrison)

1876. *Homoptera galbanata* Morrison, Proc. Acad. Nat. Sci. Philad. 1875, p. 435. (Nebraska.)

1908. *Homoptera galbanata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 243. (as synonym of *Phaeocyma lineata* Walk.)

1913. *Zale albidula* Hampson, Cat. Noct. Br. Mus., XIII, p. 228, pl. 229, figs. 18, 19.

Zale edusina (Harvey)

1875. *Homoptera edusina* Harvey, Bull. Buff. Soc. Nat. Sci., III, p. 14. (Texas.)

1875. *Homoptera atritincta* Harvey, Bull. Buff. Soc. Nat. Sci., III, p. 14. (♀, Texas.)

1908. *Phaeocyma edusina* Smith, Proc. U. S. Nat. Mus., XXXV, p. 229.

1913. *Zale edusina* Hampson, Cat. Noct. Br. Mus., XIII, p. 229, pl. 229, figs. 20, 21.

1916. *Zale edusina* ab. *edusinoides* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 43.

Record.—TEXAS: Round Mt., Blanco County, [1 spm.].

Zale aeruginosa (Gueneé)

1852. *Ypsia aeruginosa* Gueneé, Spec. Gen. Noct. III, p. 17, pl. 18, fig. 7. (No. America.)

1857. *Homoptera plenipennis* Walker, Cat. Br. Mus., XIII, p. 1055.

1908. *Phaeocyma aeruginosa* Smith, Proc. U. S. Nat. Mus., XXXV, p. 232.

1913. *Zale aeruginosa* Hampson, Cat. Noct. Br. Mus., XIII, p. 229, pl. 230. fig. 1.

1916. *Zale aeruginosa* ab. *nigrior* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 44.

Records.—FLORIDA: [1 spm.]. Without data, [4 spms.].

Zale undularis (Drury)

1770. *Noctua undularis* Drury, Ill. Exot. Ins., I p. 19, pl. 9, fig. 4. (New York.)
1864. *Homoptera nigricans* Bethune, Proc. Ent. Soc. Phila., IV, p. 214.
1908. *Phaeocyma undularis* Smith, Proc. U. S. Nat. Mus., XXXV, p. 231.
1913. *Zale undularis* Hampson, Cat. Noct. Br. Mus., XIII, p. 230, pl. 230, fig. 2.
1916. *Zale undularis* ab. *albosquamulata* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 44.

Records.—PENNSYLVANIA: Ten specimens from the following localities: Roxboro, Philadelphia, June 3, 1913, (Haimbach); Mt. Airy, Philadelphia, May 15, (Laurent); Lower Merion Township, Montgomery County, August 4, 1916, (Haimbach); Langhorne, June 16, 1924, (Haimbach); Elwyn, (Wells). NEW YORK: No. 474, [1 spm.]. OHIO: Cincinnati, May 7, 1904, (A. F. Braun), [1 spm.]. VIRGINIA: Hot Springs, July 16 to August 5, 1916, at light, (Hebard), [8 spms.].

form **umbripennis** (Grote)

1877. *Homoptera umbripennis* Grote, Can. Ent., VIII, p. 109.

Record.—Hot Springs, Virginia, July 22, 1916, at light, (Hebard), [6 spms.].

Zale corvus (Schaus)

1901. *Psendanthracia corvus* Schaus, Ann. Mag. Nat. Hist., (7), VIII, p. 78. (Mexico.)
1913. *Zale corvus* Hampson, Cat. Noct. Br. Mus., XIII, p. 231, pl. 230, fig. 3.

Zale coracias (Gueneé)

1852. *Anthracia coracias* Gueneé, Spec. Gen. Noct., III, p. 19. (No. America.)
1852. *Anthracia coracias* Gueneé, Spec. Gen. Noct. III, p. 19, pl. 15, fig. 8.
1875. *Homoptera cinerea* Morrison, Can. Ent., VII, p. 148.
1913. *Zale coracias* Hampson, Cat. Noct. Br. Mus., XIII, p. 232, pl. 230, fig. 4.

Records.—FLORIDA: [1 specimen]. NEW MEXICO: (F. H. Snow), [3 spms.]. [1 spm. "78" without data].

Zale janisca (Schaus)

1901. *Homoptera janisca* Schaus, Ann. Mag. Nat. Hist., (7), VIII, p. 40.
1901. *Homoptera dukinfieldia* Schaus, Ann. Mag. Nat. Hist., (7), VIII, p. 40.
1913. *Zale jamisca* Hampson, Cat. Noct. Br. Mus., XIII, p. 232, pl. 230, fig. 5.

Zale insuda (Smith)

1908. *Phaeocyma insuda* Smith, Proc. U. S. Nat. Mus., XXXV, p. 234. (Arizona.)

1913. *Zale insuda* Hampson, Cat. Noct. Br. Mus., XIII, p. 233, pl. 230, figs. 6, 7.

Zale minerea (Gueneé)

1852. *Homoptera minerea* Gueneé, Spec. Gen. Noct., III, p. 15, pl. 18, fig. 6. (N. America.)

1857. *Homoptera involuta* Walker, Cat. Het. Br. Mus., XIII, p. 1055.

1865. *Homoptera albofasciata* Bethune, Can. Journ. X, p. 256.

1908. *Phaeocyma norda* Smith, Proc. U. S. Nat. Mus., XXXV, p. 236.

1908. *Phaeocyma minerea* Smith, Proc. U. S. Nat. Mus., XXXV, p. 238.

1913. *Zale minerea* Hampson, Cat. Noct. Br. Mus., XIII, p. 234, pl. 230, figs. 8, 9.

1916. *Zale minerea* ab. *minereana* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 44, ♂.

1916. *Zale minerea* ab. *minereoides* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 44, ♀.

1916. *Zale minerea* ab. *minerella* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 44, ♀.

Records.—PENNSYLVANIA: Elwyn, (Wells), [4 spms.]. NORTH CAROLINA: Raleigh, Aug. 10, 1905, [1 spm.]. CANADA: Riding Mts., Kelwood, Manitoba, June 24 and 27, 1927, (J. F. May), [2 spsm. form *norda*]. Without data, [4 spms.].

Zale excellens (Schaus)

1912. *Homoptera excellens* Schaus, Ann. Mag. Nat. Hist., (8), X, p. 510. (Costa Rica.)

1913. *Zale excellens* Hampson, Cat. Noct. Br. Mus., XIII, p. 235, pl. 230, fig. 10.

Zale lunifera (Hübner)

1818. *Phaeocyma lunifera* Hübner, Zuträge, 19, figs. 97, 98. (Georgia; Florida.)

1857. *Homoptera lineosa* Walker, Cat. Het. Br. Mus., XIII, p. 1056.

1908. *Phaeocyma lunifera* Smith, Proc. U. S. Nat. Mus., XXXV, p. 241.

1908. *Phaeocyma lineosa* Smith, Proc. U. S. Nat. Mus., XXXV, p. 243.

1913. *Zale lunifera* Hampson, Cat. Noct. Br. Mus., XIII, p. 236, pl. 230, fig. 11.

Records.—PENNSYLVANIA: New Brighton, May 1-4, 1901, (Merrick), [4 spms.]. NEW YORK: Andes, June 29, 1895, [2 spms.]. OHIO: Cincinnati, July 3, 1902, (Braun), [1 spm.]. IOWA: Decorah, August 5, [1 spm.]; Nevada, June 4, 1901, [1 spm.]. ILLINOIS: [1 spm.]. MINNESOTA: Minneapolis, August 1, 1907, [1 spm.]. NORTH CAROLINA: Raleigh, July 25, 1905, [1 spm.]. FLORIDA: [1 spm.]. [1 spm. No. 4, without data].

Zale penna (Morrison)

1875. *Homoptera penna* Morrison, Proc. Bost. Soc. Nat. Hist., XVIII, p. 241. (Illinois.)

1908. *Homoptera penna* Smith, proc. U. S. Nat. Mus: XXXV, p. 241. as synonym of *lunifera.*)

1913. *Zale penna* Hampson, Cat. Noct. Br. Mus., XIII, p. 236, pl. 230, fig. 12.

Zale australis Hampson

1913. *Zale australis* Hampson, Cat. Noct. Br. Mus., XIII, p. 237, pl. 230, fig. 13. (Uruguay.)

Zale squamularis (Drury) new synonomy (Pl. XXIII, figs. 5, 6, 7.)

1770. *Noctua squamularis* Drury, Ill. Exot. Ins., I, p. 18, pl. 9, fig. 3. (♂, New York.)

1852. *Homoptera obliqua* Gueneé, Spec. Gen. Noct., III p. 16, pl. 15, fig. 7. (♀, N. America.)

1908. *Phaeocyma obliqua* Smith, Proc. U. S. Nat. Mus., XXXV, p. 247.

1908. *Phaeocyma squamularis* Smith, Proc. U. S. Nat. Mus., XXXV, p. 253.

1913. *Zale squamularis* Hampson, Cat. Noct. Br. Mus., XII, p. 241, pl. 230, fig. 19.

1913. *Zale obliqua* Hampson, Cat. Noct. Br. Mus., XIII, p. 236, pl. 230, fig. 20.

Among twenty or more specimens examined, equally divided in sexes, there are the contrasting specimens, (*squamularis*), and the less contrasting specimens, (*obliqua*), all with a purplish glow, both forms taken at the same places and dates. There can be no doubt but that they represent one species. The contrasting specimens all appear to be males, and the less contrasting females. Smith in his revision [3], writes (referring to Drury's description and figures [4]), "This figure and description could apply to nothing in our fauna save *obliqua* or the form with which I identify it here. It is too sharply marked for *obliqua*, and on the whole the description fits excellently well to the specimens now before me". In the Smith collection at Rutgers' College are two specimens under *squamularis*, which are both males, four under *obliqua*, three of which are females and one rubbed male referrable to *squamularis*. Two of the females would be better placed with *metata*, as they have not the characteristic purplish glow.

[3] Bull. U. S. Nat. Mus., XXXI, p. 255.

[4] Ill. Exot. Ins. I. pl. 9, f. 3.

Records.—NEW JERSEY: Lakehurst, May 8, 1915, (Wm. T. Davis), [3 spms.]. MARYLAND: Easton, Apl. 20, 1912, (F. M. Jones), [1 spm., (fig. 7 on plate), presented by F. M. Jones]. GEORGIA: Thomasville, Mch. 13 and 18, 1904, [2 spms. in Mr. Jones' collection]. DELAWARE: Rehoboth, [4 spms.]. NORTH CAROLINA: Southern Pines, Apl. 29, 1911, [2 spms.].

form **lapidaria** new form

A very dark brownish slate specimen taken at Thomasville, Georgia, on Mch. 13, 1904, along with the typical form, with markings just as in typical form (♀), the purplish glow still remaining in spite of the very dark color. [Type, A. N. S., No. 7163.]

var. **benesignata** (Harvey) (Pl. XXIII, fig. 7.)

1875. *Homoptera benesignata* Harvey, Bull. Bull. Soc. Nat. Sci., III, p. 14.
1908. *Phaeocyma benesignata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 256.
1908. *Zale largera* Smith, Proc. U. S. Nat. Mus., XXXV, p. 257.
1913. *Zale benesignata* Hampson, Cat. Noct. Br. Mus., XIII, p. 238, pl. 230, fig. 14.
1913. *Zale largera* Hampson, Cat. Noct. Br. Mus., XIII, p. 242.
1917. *Zale benesignata* a, *largera* Barnes and McDunnough, Check list, p. 82, No. 3187.

Record.—MARYLAND: Easton, Apl. 20, 1912, (Jones), [1 spm. kindly presented by Mr. F. M. Jones].

In the Rutgers' College Collection are five specimens, apparently all males. They appear to me like "well marked" *squamularis* males.

Zale rhigodora Dyar

1913. *Zale rhigodora* Dyar, Proc. U. S. Nat. Mus., XLIV, p. 299. (Mexico.)
1913. *Zale rhigodora* Hampson, Cat. Noct. Br. Mus., XIII, p. 225, pl. 232, fig. 32.

From the description and drawing in Hampson's Catalogue this species seems best placed after *squamularis*.

Zale metata (Smith) (Pl. XXIII, fig. 8.)

1908. *Phaeocyma metata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 248, (New York; Pennsylvania; District Columbia; No. Carolina; Virginia.)
1908. *Phaeocyma curema* Smith, Proc. U. S. Nat. Mus., XXXV, p. 250, (New York; Pennsylvania; Missouri; No. Carolina; Florida.)
1913. *Zale metata* Hampson, Cat. Noct. Br. Mus., XIII, p. 239, pl. 230, fig. 15.

1913. *Zale curema* Hampson, Cat. Noct. Br. Mus., XIII, p. 239, pl. 230, fig. 16.
1917. *Zale metata* Barnes and McDunnough, Check list, p. 82, No. 3192. [as var. of *obliqua.*]
1917. *Zale curema* Barnes and McDunnough, Check list, p. 82, No. 3192. [as var. of *obliqua.*]

Metata and *curema* are beyond doubt off shoots from *squamularis,* but I can see no difference between the two forms; in a large series it is difficult to place any but the typical specimens; as *metata* was first described, that name will stand. *Metata* appears to have established its specificity, in its general smaller size, its brownish color without the purple glow, and its being nearly alike in the sexes; while *squamularis* is dimorphic in the sexes.

Records.—VIRGINIA: Falls Church, Apl. 17, 1915, (G. M. Green), [1 spm. compared with type]. PENNSYLVANIA: Fairmount Park, Philadelphia, (Haimbach), [1 spm.]. FLORIDA: Marco, Sept. [2 spms.]. NORTH CAROLINA: Raleigh, Aug. 6, 1906, [1 spm. compared with *curema* type]; Raleigh, Aug. 2, 1906, [2 spms.].

The male type of *metata* is from Florida, and among the type lot of *curema* are specimens from Raleigh, N. C., in the same handwriting as those contained in the Academy collection.

Zale duplicata (Bethune)

1856. *Homoptera duplicata* Bethune, Can. Jour., X, p. 257. (Canada.)
1908. *Phaeocyma duplicata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 258.
1913. *Zale duplicata* Hampson, Cat. Noct. Br. Mus., XIII, p. 240, pl. 230, fig. 17.

Record.—One specimen, "From Mrs. A. T. Slosson, Florida or N. H.", in Doctor Skinner's handwriting.

Zale helata (Smith)

1908. *Phaeocyma helata* Smith, Proc. U. S. Nat. Mus., XXXV, p. 252. (New Hampshire; New York.)
1913. *Phaeocyma helata* Hampson, Cat. Noct. Br. Mus., XIII, p. 240. [as synonym of *duplicata.*]
1917. *Zale helata* Barnes and McDunnough, Check list, p. 82, No. 3189.

Zale bethunei (Smith)

1908. *Phaeocyma bethunei* Smith, Proc. U. S. Nat. Mus., XXXV, p. 260. (D. C.; North Carolina; Maine.)
1913. *Zale bethunei* Hampson, Cat. Noct. Br. Mus., XIII, p. 240, pl. 230, fig. 18.

Zale rubiata (Smith)

1908. *Phoeocyma rabiata* Smith, Proc. U. S. Nat. Mus., xxxv, p. 265. (Arizona.)

1913. *Zale rubiata* Hampson, Cat. Noct. Br. Mus., xiii, p. 243, pl. 231, figs. 1, 2.

Zale rubi (H. Edwards)

1881. *Homoptera rubi* Hy. Edwards, Papilio, i, p. 28. (California.)

1908. *Phaeocyma rubi* Smith, Proc. U. S. Nat. Mus., xxxv, p. 226.

1913. *Zale rubi* Hampson, Cat. Noct. Br. Mus., xiii, p. 244, pl. 230, fig. 21.

Record.—San Louis Opispo, California, Feby and March, [2 spms.].

Zale termina (Grote)

1883. *Phaeocyma termina* Grote, Can. Ent., xv, p. 129. (Arizona.)

1908. *Phaeocyma yavapai* Smith, Proc. U. S. Nat. Mus., xxxv, p. 237.

1913. *Zale yavapai* Hampson, Cat. Noct. Br. Mus., xiii, p. 245, pl. 231, fig. 3.

1925. *Zale termina* Barnes and Benjamin Bull, Brooklyn Ent. Soc., xx, p. 197 (= *yavapai.*)

Zale colorado (Smith)

1908. *Phaeocyma colorado* Smith, Proc. U. S. Nat. Mus., xxxv, p. 263. Colorado; Manitoba; Arizona; Texas.)

1913. *Zale colorado* Hampson, Cat. Noct. Br. Mus., xiii, p. 245, pl. 231, figs. 4, 5.

Records.—ARIZONA: Cochise County, Feb. 28, 1905, [compared with type]. SOUTH CAROLINA: Aiken, (C. S. Wells Coll.) [this last record seems doubtful; label probably mixed].

Zale cingulifera (Walker)

1857. *Homoptera cingulifera* Walker, Cat. Het. Br. Mus., xiii, p. 1056. (East Florida.)

1857. *Homoptera intenta* Walker, Cat. Het. Br. Mus., xiii, p. 1070.

1877. *Homoptera woodi* Grote, Can. Ent., ix, p. 88.

1908. *Phaeocyma cingulifera* Smith, Proc. U. S. Nat. Mus., xxxv, p. 261.

1913. *Zale cingulifera* Hampson, Cat. Noct. Br. Mus., xiii, p. 246, pl. 231, fig. 6.

Records.—PENNSYLVANIA: New Brighton, Apl. 29 and 30, 1901, (Merrick), [3 spms.]. SOUTH CAROLINA: Aiken, (C. S. Wells Coll.), [2 spms.].

Zale calycanthata (Smith & Abbott)

1797. *Phalena calycanthata* Smith and Abbott, Ins. Georgia, ii, p. 207, pl. 104.

1875. *Homoptera uniformis* Morrison, Can. Ent., VII, p. 148.
1913. *Zale colycanthata* Hampson, Cat. Noct. Br. Mus., XIII, p. 246, pl. 231, fig. 7.
1913. *Zale calycanthata* ab. *dealbata* Strand, Arch. Natg., LXXXII, Abt. A/2, p. 44.

Zale horrida Hübner

1818. *Zale horrida* Hübner, Zut., I, p. 11, figs. 31, 32.
1908. *Phaeocyma horrida* Smith, Proc. U. S. Nat. Mus., XXXV, p. 270.
1913. *Zale horrida* Hampson, Cat. Noct. Br. Mus., XIII, p. 247.

Records.—NEW JERSEY: Holly Beach, May 21-27, 1904, (Haimbach), [3 spms.]. PENNSYLVANIA: Elwyn, (Wells), [1 spm.]. MASSACHUSETTS: Cambridge, (H. K. Morrison), Wells Coll., [1 spm.]. WITHOUT LOCALITY: Ex. Coll. Strecker, 2508, [2 spms.]; [1 spm. "307"].

Safia amella form **blatchleyi** new form (Pl. XXIII, fig. 2.)

Marked like the typical form fig. 1, but the median area of primaries entirely black, with white spots as shown in fig. 2, the lower wings are also darker than in the normal form. I denominate this form in honor of Mr. Wm. S. Blatchley from whom I have received many interesting Lepidoptera.

Type.—Royal Palm Park, Florida, (W. S. Blatchley, [A. N. S., No. 7154]. One paratype, with same data.

Explanation of Plate. XXIII.

Fig. 1. *Safia amella* Guen., Royal Palm Park, Florida.

Fig. 2. *Safia amella* form *blatchleyi* Haimbach, Royal Palm Park, Fla. *type.*

Fig. 3. *Zale lunata* ♀ form *lunatoides* Strand, Royal Palm Park, Fla.

Fig. 4. *Zale smithi* Haimbach, Royal Palm Park, Fla. *paratype.*

Fig. 5. *Zale squamularis* Drury, ♂, Southern Pines, N. C.

Fig. 6. *Zale squamularis* = *obliqua* Guen., ♀, Southern Pines, N. C.

Fig. 7. *Zale squamularis* var. *benesignata* Harv., Easton, Md.

Fig. 8. *Zale metata* Smith, Falls Church, Va. *Typical, C. W. T.*

Explanation of Plate XXIII.

Fig. 1. *Safia amella* Guen., Royal Palm Park, Florida.

Fig. 2. *Safia amella* form *blatchleyi* Haimbach, Royal Palm Park, Fla. *type.*

Fig. 3. *Zale lunata* ♀ form *lunatoides* Strand, Royal Palm Park, Fla.

Fig. 4. *Zale smithi* Haimbach, Royal Palm Park, Fla. *paratype.*

Fig. 5. *Zale squamularis* Drury, ♂, Southern Pines, N. C.

Fig. 6. *Zale squamularis* = *obliqua* Guen., ♀, Southern Pines, N. C.

Fig. 7. *Zale squamularis* var. *benesignata* Harv., Easton, Md.

Fig. 8. *Zale metata* Smith, Falls Church, Va. *Typical, C. W. T.*

HAIMBACH—NORTH AMERICAN NOCTUIDAE, GENUS ZALE

STUDIES IN THE GRYLLIDAE OF PANAMA
(ORTHOPTERA)

BY MORGAN HEBARD

The study of the Gryllidae of Panama has been more difficult than that of any of the other families of Orthoptera, except the Blattidae. This was due to the fact that the crickets of tropical America have been less studied and the relative values of diagnostic characters were less well understood than in any other family of the Orthoptera except that of the cockroaches. Although the former were found to be represented by eighty-two as contrasted with one hundred and seven species, the separation of these was distinctly more difficult, as in the cockroaches more definite and readily described diagnostic differences are much more frequently encountered.

As in our previous papers [1], the material recorded is largely from the Canal Zone, the only recent additions being small series taken by C. T. Greene and R. C. Shannon, mostly on Barro Colorado Island, in Gatun Lake. In addition to the sixty-five species here discussed, we find that seventeen other species of Gryllidae have been reported from Panama or are certain to be found there, being known from similar environment both north and south of the region. These species are included in the following list, the names of those of which we have material being preceded by an asterisk and those which we have not seen by a

[1] "A Contribution to the Knowledge of the Dermaptera of Panama," Trans. Amer. Ent. Soc. XLIII, pp. 301 to 334, (1917).

"The Blattidae of Panama," Mem. Amer. Ent. Soc., No. 4, pp. 1 to 148, (1920).

"A Note on Panamanian Blattidae, with the Description of a New Genus and two New Species," Ent. News, XXXII, pp. 161 to 169, (1921).

"Studies in the Acrididae of Panama (Orthoptera)," Trans. Amer. Ent. Soc., L, pp. 75 to 140, (1924).

"Studies in the Tettigoniidae of Panama (Orthoptera)," Trans. Amer. Ent. Soc., LIII, pp. 79 to 156, (1927).

zero. The known distribution in North and South America is indicated by asterisks, the presence in those regions of closely related species by an "a".

Species	North America	South America	Page
GRYLLINAE			
Gryllus assimilis (Fabricius)	*	*	239
Miogryllus convolutus (Johannson)	*	*	239
Miogryllus ensifer (Scudder)	—	*	240
**Miogryllus verticalis* (Serville)	*	*	—
Gryllodes sigillatus (Walker)	*	*	240
Anurogryllus muticus (DeGeer)	*	*	241
GRYLLOMORPHINAE			
Odontogryllus sp.	—	a	241
NEMOBIINAE			
Hygronemobius liura Hebard	—	*	242
Hygronemobius darienicus new species	—	a	242
Nemobius brasiliensis (Walker)	*	*	243
Nemobius cubensis cubensis Saussure	*	—	243
PENTACENTRINAE			
Quarequa annuliger new species	—	—	245
PHALANGOPSINAE			
Lerneca varipes Walker	—	*	247
Gryllosoma esau Hebard	—	a	248
Prosthama tessellata Hebard	*	—	248
Luzara rufipennis Walker	—	*	248
Amusodes festae (Giglio-Tos)	—	*	248
°*Luzara kirschianus* (Saussure)	Panama to Venezula		—
Fugryllina veraguae Hebard	—	a	249
Acla crassicornis (Saussure)	*	*	249
Aclodes nicuesa Hebard	*	*	249
**Paragryllus martinii* Guerin[2]	Mexico and Guadeloupe to British Guiana		—
Amphiacusta phalangium Saussure	*	—	249

[2] We are satisfied that but a single species, *martinii* Guerin, is found over the area here indicated. Saussure described *rex* and *temulentus* from Brazil, and one or both names will very possibly prove to be synonyms. The number of oblique veins and curved veins in the speculum of the male tegmina are subject to individual variation, as is the relative size of the inflated caudal tibial spur; these were the major features of difference noted by Saussure. A female from Porto Velho, Rio Madeira, Brazil, recorded by Rehn as *temulentus*, differs from other females before us in the much longer ovipositor and may consequently represent a distinct species.

Species	North America	South America	Page
OECANTHINAE			
Oecanthus varicornis Walker	*	—	250
Oecanthus californicus Saussure	*	—	250
**Neoxabea bipunctata* (DeGeer)[3]	United States to Bugaba, Panama		—
TRIGONIDIINAE			
Anaxipha pulicaria (Burmeister)	*	*	251
Anaxipha stolzmannii (Bolivar)	*	*	251
Anaxipha hirsuta new species	—	a	252
Anaxipha championi (Saussure)	*	*	254
**Anaxipha minuta* (Linnaeus)	Costa Rica to Dutch Guiana		—
Anaxipha gracilis (Scudder)	*	*	254
Anaxipha tolteca (Saussure)	*	—	254
Anaxipha nitida (Chopard)	*	*	255
Anaxipha platyptera Hebard	—	*	255
Macroanaxipha macilenta (Saussure)	a	—	256
Symphyloxiphus pictus (Saussure)	a	—	257
Symphyloxiphus nigrellus new species	*	—	257
Cytroxipha gundlachi Saussure	*	*?	259
Chopardina americana (Chopard)	—	*	260
Phylloscritus elegans Guérin	—	*	261
ENEOPTERINAE			
Eneoptera surinamensis (DeGeer)	*	*	262
Ponca venosa new species	*	—	263
Phyllogryllus hirsutus new species	—	a	265
Diatrypa jansoni Saussure	*	a	267
**Diatrypa pallidelabris* Chopard	Nicaragua to Brazil		—
Diatrypa univittata new species	a	—	267
Diatrypa championi Saussure	—	—	269
°Diatrypa apithoides Saussure	—	—	—
Hapithoides insolitum new species	—	—	270
Paroecanthus annulatus (Scudder)	*	*	271
°Paroecanthus tibialis Saussure, Bugaba and Chiriqui Volcano, Panama			—
Paroecanthus podagrosus Saussure	*	*	272
**Hapithus montanus* Saussure	Bugaba, Panama		—
Amblyrhethus ponderosus new species	—	*	273
°Orocharis tibialis Saussure	Teapa, Mexico and Bugaba, Panama		—
Orocharis latifrons Rehn	*	*	274

[3] We have recently examined a male from Bugaba, Panama, in the Geneva Museum, recorded by Saussure in the Biologia. This specimen represents true *bipunctata*. Two very distinct species, though of rather similar general appearance, have lately been described by us from Colombia.

Species	North America	South America	Page
**Orocharis cayennensis* Saussure, Costa Rica ? and French Guiana			——
°Orocharis maxillaris Saussure.....Chiriqui Volcano, Panama..			——
**Laurepa corrugata* (Saussure), Mexico and Chiriqui Volcano, Panama			——
°Laurepa musica (Saussure).....Bugaba, Panama.....			——
Euscyrtus mexicanus Saussure.....	*	——	275
Podoscirtus orocharoides new species.....	*	——	275
Aphonomorphus tenebrosus new species...	——	a	277
Aphonomorphus flavifrons (Saussure)...	*	——	279
Aphonomorphus bicolor new species.....	a	——	279
Aphonomorphus obliquus Bruner.....	——	*	281
Aphonomorphus pusillus new species.....	——	*	282
Stenaphonus maclientus Saussure.....	*	——	284
MOGOPLISTINAE			
Cycloptilum antillarum (Redtenbacher)..	*	*	284
Cycloptilum medium new species.....	——	a	284
GRYLLOTALPINAE			
Scapteriscus didactylus (Latreille).....	*	*	287
Scapteriscus vicinus Scudder, Southeastern United States to Brazil...			——
Gryllotalpa hexadactyla Perty.....	*	*	287
**Gryllotalpa intermedia* Saussure.....Mexico to Brazil and Peru.			——
Tridactylus minutus Scudder.....	*	*	288
Tridactylus rostratus new species.....	——	——	289
Tridactylus apicialis Say.....	*	*	290
Ripipteryx pulicaria Saussure.....	*	*	291
Ripipteryx biloba new species.....	*	*	292
**Ripipteryx carbonaria* Saussure[4], Costa Rica, Chiriqui Volcano and Colombia.....			——
Ripipteryx rivularia Saussure.....	*	*	294

In totalling the number of species known from Panama it is interesting to note that the Gryllidae are third, exceeding the Acrididae, which family, in temperate regions, is so much more abundantly represented. The number of species now known from Panama is four hundred and seventy-nine, divided as follows: Dermaptera thirty, Blattidae one hundred and seven, Mantidae twenty-two, Phasmidae, forty, Acrididae seventy-four, Tettigoniidae one hundred and twenty-seven and Gryllidae eighty-

[4] It appears probably that, in the Marginata Group of the genus *Ripipteryx*, the species *hydromeda* Saussure will be found to be confined to Central America and *limbata* (Burmeister) to South America, though Saussure has given both regions for each of these species.

two. Material belonging to the United States National Museum was secured by A. Busk, E. A. Schwartz, A. H. Jennings, W. Robinson, Dietz and Zetek, C. T. Greene, R. C. Shannon and W. Schaus. That belonging to the Hebard Collection was taken by D. E. Harrower, M. Hebard, G. H. H. Tate, J. Zetek, W. M. Wheeler and Muñoz, as well as a part of the series secured by J. C. Bradley of Cornell University, in return for specimens of other species desired by that institution. The collection made by N. Banks belongs to the Museum of Comparative Zoology and the ownership of other odd individuals is given in the text.

We believe that, for tropical faunas, the Dermaptera and Orthoptera of the Canal Zone is now comparatively well understood, though undoubtedly many more species will be added to the list of those at present known. Quite the reverse is true for that portion of Panama adjacent to Colombia or the highlands of the Isthmus until the vicinity of Costa Rica is reached. In the present list are nearly twice as many species of North America than of South American derivation. This may be partly explained by the fact that a large amount of work for the "Biologia" was done in Chiriqui, many species of the very rich fauna of the Costa Rican highlands having been secured on the volcano of that name. Toward Colombia exceedingly little field work has been done, and it is quite probable that sufficient altitude is not attained to carry into the Isthmus nearly as large a proportion of the rich highland fauna of that country. In the tropical lowlands we note that many species found in Panama reach as far north as Nicaragua and that though the fauna of the Colombian Chocó is very similar, there are there more cases of geographic racial development or the replacement of Panamanian by distinct though closely related species.

In this paper six hundred and eighty-three specimens, of these five hundred and eighty-three from Panama, are treated, fine new genera and sixteen new species being described. Ridgway's "Color Standards and Nomenclature" have been used to give the exact coloration.

In the earlier papers of the present series "Paris Field" was unfortunately given in error for "France Field", a locality near

Cristobal at which the author found collecting exceptionally productive in the dense but not lofty swamp vegetation. The scarcity of insect life in the grasslands and arid brush of the Canal Zone is always a surprise to the visitor expecting to find a rich and generally distributed tropical fauna.

During the preparation of the present study it has become more and more evident that the armament of the caudal tibiae furnishes a series of very valuable characters. Among the most important of these are the number, form and proportionate length of the distal spurs. We term these "spurs" to differentiate them from the spines of the dorsal margins and find that normally three pair are present, never more. In some genera such as *Tafalisca* the spines are fused with the margins, showing no trace of being socketed, as are the spurs, and they are thus easily distinguishable. In most species the spines may be distinguished from the spurs by being less evidently socketed and of different, usually more simple, contour, but in some of the small forms with very delicate caudal tibiae a distal spine may be closely placed to a dorsal spur and very similar to it. In such cases confusion can best be avoided by recognizing the normal arrangement of spurs and working out the homologies accordingly.

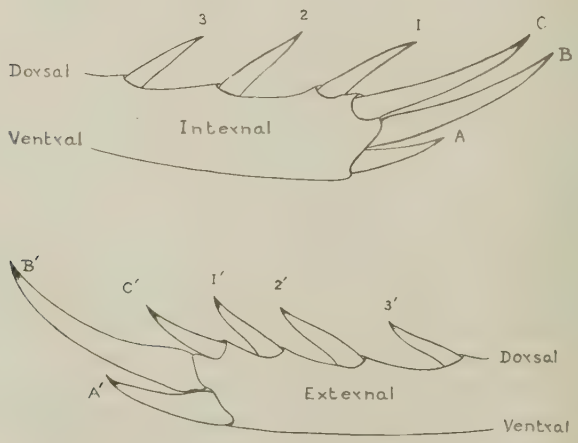


Fig. 1 and 2. Caudal tibia of *Miogryllus convolutus* showing spurs.

In studying the spurs the following features are noteworthy. Of the three external the median (B') is always the longest (except in the Oecanthinae as here restricted) and the dorsal (C') is usually slightly longer than the ventral (A'). Of the internal, the median (B) and dorsal (C) are usually elongate, in different species equal in length or with median longest or with dorsal longest, the longest of these usually considerably longer than the longest (median) external. The ventro-internal (A) is very small, as small as or smaller than the ventro-external (A') and is absent in *Hygronemobius, Pentacentrus, Aclodes* and *Paraclodes.* In *Paragryllus* the dorso-internal (C) is greatly inflated. It should be remembered that the ventral pair of spurs (A and A') are often so small that they could be easily overlooked.

GRYLLIDAE

Gryllinae

Gryllus assimilis (Fabricius)
1775. *Acheta assimilis* Fabricius, Syst. Ent., p. 280. [Jamaica.]

Barro Colorado Island, Gatun Lake, Canal Zone, May 23, 1926, (C. T. Greene), 1 juv. ♀.
Pinogana, Darien, December, 1915, (Muñoz), 1 ♀, BZbul [5].

This species is known from southern Canada to Patagonia. It has been recorded from the Volcano of Chiriqui as the synonymous *G. mexicanus.*

Miogryllus convolutus (Johannson) (Page 238, text figs. 1 and 2.)
1763. *Gryllus convolutus* Johannson, Amoen. Acad. VI, p. 399. [♀, Surinam.]

Barro Colorado Island, Gatun Lake, Canal Zone, May 3 and 12, 1926, (C. T. Greene), 2 ♂, 2 ♀, (macropterous)
Tabernilla, C. Z., May 4 to 17, 1907, (A. Busck), 4 ♂, 11 ♀, (macr.).
Paraiso, C. Z., April 30, 1911, (A. H. Jennings), 1 ♂, (macr.).
Ancon, C. Z., November 16, 1913, (M. Hebard; in heavy marsh grass), 4 ♂, 1 ♀, (tegmina very short, wings concealed).

Most of this series was recorded first in 1915, at which time

[5] See Rehn and Hebard for discussion of the variants of this plastic species; Proc. Acad. Nat. Sci. Phila., 1915, p. 299.

we discussed *convolutus* at some length.[6] The species is known from Jalapa, Vera Cruz, Mexico, to Carcaraña, Santa Fé, Argentina. It has been recorded from Punta di Sabana, Darien, as the synonymous *pusillus*, and from Colon as the synonymous *micromegas* by Giglio-Tos.

Miogryllus ensifer (Scudder)

1896. *Nemobius ensifer* Scudder, Jour. New York Ent. Soc., IV, p. 101. [♀, Central America.]

France Field, Canal Zone, July 7 and August 18, 1920, (M. Hebard; in swamp area), 3 juv. ♂, 1 juv. ♀.

Gatun, C. Z., July 8, 1920, (M. Hebard), 1 ♀, (tegmina very short, wings concealed); July 28 to August 5, 1916, (D. E. Harrower), 1 ♀, (macropterous).

Tabernilla, C. Z., May 1 to June 16, 1907, (A. Busck), 14 ♂, 20 ♀, (macropt.).

Barro Colorado Island, Gatun Lake, C. Z., May 12 and 13, 1926, (C. T. Greene), 3 ♀, (macropt.). March 31, 1924, (J. C. Bradley), 1 ♂, (macropt.).

Cano Saddle, Gatun Lake, C. Z., April 27, 1923, (R. C. Shannon), 1 ♀, (macropt.).

Outside of Panama this species has been recorded only from Georgetown, British Guiana.[7]

Gryllodes sigillatus (Walker)

1869. *Gryllus sigillatus* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 49. [♀; Swan River [, Australia].]

1912. *G[ryllodes] subapterus* Chopard, Ann. Soc. Ent. France, LXXXI, p. 403, text fig. [[juv.] ♂; Nouveau Chantier, French Guiana.]

Recent examination of the type of Chopard's *subapterus* confirms our suspicion that the name was based on a male of *sigillatus* in the instar preceding maturity.

Gatun, Canal Zone, July 17 to August 22, 1916, (D. E. Harrower), 5 ♂, 3 ♀, 1 juv. ♀.

Zone limit five miles west of Empire, November 14, 1913, (M. Hebard), 1 ♂.

Ancon, C. Z., November 13, 1913, (M. Hebard; stridulating after dark about buildings), 2 ♂.

Panama City, 1911, (J. Zetek), 1 ♂.

This species is widely distributed, probably through commerce, in the American tropics.

[6] Jour. New York Ent. Soc., XXIII, pp. 105 to 110.

[7] Jour. New York Ent. Soc., XXIII, pp. 110 and 111, (1915).

Anurogryllus muticus (DeGeer)

1773. *Gryllus muticus* DeGeer, Mém. Hist. Nat. Ins., III, p. 520, pl. 43, fig. 2. [♂, ♀; Surinam.]

France Field, Canal Zone, July 7, 1920, (M. Hebard), 1 ♂, (wings concealed).

Gatun, C. Z., July 25 to August 22, 1916, (D. E. Harrower), 4 ♂, 10 ♀, 1 large juv. ♀, (4 ♂, 2 ♀ wings concealed; 8 ♀ wings caudate).

Barro Colorado Island, Gatun Lake, C. Z., July 17, 1924, (N. Banks), 1 ♀, (wings caudate).

Tabernilla, C. Z., May 8 and June 10, 1907, (A. Busck), 1 ♂, 8 ♀, (wings caudate).

Juan Mina Plantation, Rio Chagres, 1919, (Dietz and Zetek), 2 ♀, (1 wings concealed, 1 wings caudate).

Ancon, C. Z., November 13, 1913, (M. Hebard; heard occasionally in short grasses at night, very wary), 1 ♂.

Panama City, 1914, (J. Zetek), 1 ♀, (wings caudate).

Pinogana, Darien, December, 1915, (Muñoz), 2 ♀, (1 wings concealed, 1 wings caudate).

Gulf of San Blas, Colon, July, 1922, (D. E. Harrower), 3 ♂, (wings concealed).

The distribution of this species is shown by material before us to extend from Ocean View, New Jersey, to Bahia Blanca, Argentina. It has been recorded from the Volcano of Chiriqui.

The insect is abundant and generally distributed in the tropical portions of its range and its share in the chorus of tropical insects at night is far out of proportion to its size. Its song is very resonant, penetrating and loud, a long continued "brzeeee-eeeee".

Gryllomorphinae

Odontogryllus sp.

The presence in Panama of this interesting genus, previously known only from South America, is shown by an immature male, taken at Porto Bello, August 18 to 22, 1916, by D. E. Harrower.

Compared with immature males of *O. setosus* Saussure before us, this specimen is seen to differ in being slightly less robust and in having the occiput more solidly dark, while the development of the organs of flight is more decided as wing pads are present laterad of the large tegminal pads.

Nemobiinae

Hygronemobius liura Hebard

1915. *Hygronemobius liura* Hebard, Ent. News, xxvi, p. 196, pl. 6, figs. 2 to 2D. [♂, ♀; Tukeit and Rockstone, British Guiana.]

Boquete, Chiriqui, August 15 to 20, 1922, (D. E. Harrower), 1 ♀.

This specimen shows the ovipositor apex delicately armed, as described here for that of *H. darienicus*. Such was not apparent in the originally described females, possibly due to wearing down of the margins of the apex of the ovipositor. The Panamanian individual is also very slightly more recessive in color, with caudal femora less extensively mottled with dark brown than in paratypes in the author's collection, in all other respects agreeing fully.

Hygronemobius darienicus new species (Pl. XXIV, fig. 1.)

This species and the Guianan *H. amoenus* Chopard, are readily distinguished by their very small size and robust build. From the present insect *amoenus* is easily separated by the black pronotal disk with yellow borders, presence of vestigial tegmina in the female sex, abdomen with fourth tergite almost entirely white and cephalic and median femora with a broad white area. The caudal limbs are absent in the type of that species. In *darienicus* the caudal tibiae have their spines and spurs decidedly shorter than in the other known forms, the dorso-internal spur reaching only three-fifths of the distance to the extremity of the metatarsus, while the brown and blackish coloration is more solid, showing scarcely any maculation.

Type: ♀ ; Porto Bello, Panama. August 18 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type No. 1088.]

Size very small and form robust for the genus. Head with interantennal protuberance weak, but fully as decided as in *H. alleni* (Morse). Maxillary palpi compact, uniformly dark. Pronotum relatively short, considerably instead of slightly broader than long. Tegmina absent. Cephalic tibiae without trace of a tympanum [8]. Caudal tibiae with three alternating spines on each dorsal margin, alternating, short for the genus, none much longer than the distance between bases, increasing only slightly in

[8] If occurring in any species of the genus this might be expected in *darienicus*, where tegmina have disappeared in the female sex.

length distad; distal spurs also short for the genus, the dorso-internal reaching only three-fifths the distance to apex of metatarsus. Ovipositor moderately elongate, curved faintly dorsad; apex very weakly enlarged, tapering to a sharp point, the margins of the dorsal valves very finely denticulate, these denticulations so minute that they are noticeable under the microscope only in certain positions.

Length of body 4.8, length of pronotum 1, greatest pronotal width 1.7, length of caudal femur 3.6, length of ovipositor 2.7 mm.

Nemobius (Argizala) brasiliensis (Walker)

1869. *Argizala brasiliensis* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 61. [♀; Santarem, Brazil.]

Gatun, Canal Zone, July 28 to August 22, 1916, (D. E. Harrower), 2 ♀.

This is an aquatic species which at times comes to light at night in great numbers. It is known from San Rafael, Vera Cruz, Mexico, to Sapucay, Paraguay.

Nemobius (Neonemobius) cubensis cubensis Saussure.

1874. *Nemobius cubensis* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 384, pl. 7, fig. 5. [♂, ♀: Cuba; Mexico; Brazil.]

Boquete, Chiriqui, August 15 to 20, 1922, (D. E. Harrower), 1 juv. ♂, 1 juv. ♀, [A. N. S. P.].

Gatun, Canal Zone, July 28 to August 5, 1916, (D. E. Harrower), 1 ♀, (large, macropterous).

Frijoles, C. Z., July 10, 1924, (N. Banks), 1 ♀, (small, brachypt.).

Tabernilla, C. Z., (A. Busck), 3 ♀, (medium size, macropt.).

Ancon, C. Z., November 16, 1913, (M. Hebard; beaten from short grass in damp spot where individuals were moderately numerous), 1 ♂, 1 ♀, 1 juv. ♂, 2 juv. ♀, (adults small, brachypt.).

Old Panama, November 16, 1913, (M. Hebard; beaten from grass in damp open spot), 1 ♂, (small, brachypt.).

All but the three Tabernilla specimens are paler than is usual in typical *cubensis*, but do not show the dark transverse occipital bar found in *cubensis mormonius* Scudder. The ovipositor is very short for the typical race, as we have observed in material from Vera Cruz, Mexico and Nicaragua [9] the present

[9] Proc. Acad. Nat. Sci. Phila., 1913, p. 459.

specimens likewise have the head paler ventrad, often with a suffused medio-longitudinal darker marking. Recognition of a third, southern, race of the species does, however, not appear to be warranted.

Typical *cubensis* is known from Cuba and Staten Island, New York, southward to Panama [10].

Pentacentrinae

The only American species which has been referred to this subfamily is the Cuban *Nemobiopsis gundlachi* Bolivar.

We find that the Brazilian *Aphemogryllus gracilis* Rehn and the Texan *Trigonidomimus belfragei* Caudell also belong here. as well as an undescribed genus and species from Costa Rica and *Quarequa annuliger* here described.

These insects are distinguished by their general Nemobiine facies though more slender than most of the species of that subfamily, the deep and vertical head with antennae inserted distinctly below the median line and the very slender caudal tibiae which bear fewer and much shorter spines and have three pair of distal spurs of which the ventral pair are minute [11]. The ventro-internal of these spurs is absent in *Pentacentrus* and the undescribed Costa Rican genus before us. The caudal metatarsus is extremely elongate and slender in all these genera except *Nemobiopsis,* and is armed with two rows of teeth dorsad in all but *Trigonidomimus* and *Quarequa.* The ovipositor apex is simple, rather slenderly lanceolate, acute and wholly unarmed, distinctly Phalangopsine and not Nemobiine except in *Aphemogryllus.*

The subfamily plainly includes forms to various degrees transi-

[10] We doubt the validity of Saussure's Brazilian record.

[11] Saussure recognized that *Pentacentrus* represented a very unusual group, but unfortunately used the character of five instead of the normal six caudal tibial spurs as its most important feature. This group was given family rank by Bruner in 1916. We have subsequently found that *Hygronemobius* Hebard, clearly a member of the Nemobiinae, also has five instead of six such spurs and this is also true of *Eugryllina* and sometimes of *Aclodes,* genera recently described by us which clearly belong to the Phalangopsinae. It is evident that the presence or absence of one of the minute ventral spurs of the caudal tibiae can be given no weight in diagnosing the subfamily.

tional between the Nemobiinae and Phalangopsinae all of which share a distinctive general facies, but individually show tendencies toward very different stocks.

QUAREQUA new genus

This genus is readily separable from the others discussed above by the male tegmina showing a deplanate dorsal field of Nemobiine appearance but having a large speculum. It differs from any other forms of the North American Gryllidae known to us except *Anaxipha nitida* (Chopard), by having a single very extensive white antennal annulus. In the Asiatic *Pentacentrus*, a genus showing the most characters of similarity though very widely distinct, the antennae have more than one pale annuli.

From *Pentacentrus* the present genus further differs in the exceedingly narrow fastigio-facial protuberance, absence of a median and mere traces of lateral ocelli, longer maxillary palpi, distinctive male tegminal specialization, cephalic tibiae not enlarged proximad with large but proportionately decidedly smaller auditory foramen, much shorter tegmina in caudate phase, caudal tibiae with two instead of three dorso-external spines and a minute pair of ventral (distal) spurs and caudal metatarsus even more slender and unarmed dorsad. They agree in the characters given for the subfamily above, extremely elongate wings in the caudate phase, oval auditory foramen on cephalic face of cephalic tibiae only, short caudal tibial spines of which there are three dorso-internal with no trace of teeth before or between them and very elongate caudal metatarsus.

Quarequa annuliger new species (Pl. XXV, figs. 1 and 2.)

The general appearance of this insect is very much more like that of *Hygronemobius albipalpus* (Saussure) than any other American species, but it is easily distinguished by the striking antennal annulus, reddish rather than grayish brown general coloration, more polished surface and very many and distinctive structural characters.

Type: ♂ ; Corozal, Canal Zone, Panama. April 14, 1912. (A. Busck.) [U. S. N. M.]

Size very small, form medium, limbs slender. Head glabrous. Mere traces of lateral ocelli alone indicated. Fastigio-facial pro-

jection weak and extremely narrow, not one-sixth width of proximal antennal joint. Eyes moderately large and moderately protuberant, vertical, broadly oval. Palpi moderately elongate, third and fourth joints nearly equal in length, fifth (ultimate) decidedly longer than third, its dorsal margin showing very faint concavity, its apical truncation straight and very strongly oblique, as long as the straight ventral margin. Pronotum small, narrowing cephalad, disk with a weak medio-longitudinal sulcus on each side of which is an impressed point cephalad, caudal margin transverse, lateral lobes longer than deep with ventral margin horizontal, ventro-cephalic angle rounded rectangulate, ventro-caudal angle very broadly rounded rectangulate. Tegmina covering half of abdomen; dorsal field deplanate, anal field transverse, including a single forked vein, oblique veins three in number; speculum large, slightly longer than broad, its cephalic angle distinctly less than a rightangle, its caudal margin irregularly convex, its surface with longitudinal ridges but crossed by no veins; lateral field vertical with simple, longitudinal discoidal, mediastine and one free vein (the mediastine sometimes bearing one branch). Wings extremely caudate[12], nearly three times as long as the tegmina. Limbs slender and delicate. Caudal femora medium, tapering evenly distad. Caudal tibial spines short, none except the longest equal to half the distance between their bases; external spurs very small, the median the longest and as long as the shorter spine, internal spurs with median twice as long as ventral and dorsal distinctly longer than median. Caudal metatarsus very elongate, fully half as long as tibia.

Allotype: ♀ ; same data as type. [U. S. N. M.]

Generally similar to male, differing as follows. Tegmina slightly more elongate; dorsal field with longitudinal veins, connected by a few fine transverse veinlets; lateral field with two longitudinal veins; humeral-ulnar area concave proximad, with a small but deep intercalated area between discoidal and median veins distad. Ovipositor of moderate length, very slightly curved dorsad; apex slenderly lanceolate, smooth, acute. Subgenital plate small, scoop shaped, short, truncate distad.

General coloration chestnut brown paling to buckthorn brown on limbs, the folded wings appearing whitish. Antennae prouts brown, with a very long white annulus meso-distad.

The measurements of a brachypterous female follow those of the allotype. Length of body ♂ 5.8, ♀ 6 and 5.4; length of pro-

[12] A brachypterous condition is developed in which wings are absent, the tegmina are considerably shortened and the auditory foramina, though large, show reduction.

notum ♂ 8.8, ♀ 1.17 and 1.07; length of tegmen ♂ 2.9, ♀ 3.6 and 1.8; total width of tegminal dorsal fields ♂ 1.76, ♀ 1.8 and 1.76; exposed length of wing ♂ 5.6, ♀ 6.8; length of caudal femur ♂ 4, ♀ 4.4 and 3.8; greatest width of caudal femur ♂ .88, ♀ .96 and 1; length of caudal metatarsus ♂ 1.42, ♀ 1.47 and 1.47; length of ovipositor 3.7 and 3.9 mm.

Specimens Examined: 10; 2 males, 6 females and 2 immature individuals.

San Antonio, Nicaragua, May, 1899, 3 ♀, *paratypes,* (all macropterous), [Hebard Cln.].

Gatun, Canal Zone, July 8, 1920, (M. Hebard; under decaying bark on log in open), 1 ♀, *paratype,* (brachypterous), 2 juv. ♀.

Rio Trinidad, Panama, June 4, 1912, (A. Busck), 1 ♂, *paratype,* (macr.).

Corozal, Canal Zone, Panama, April 14, 1912, (A. Busck), 1 ♂, 1 ♀, *type* and *allotype,* (macr.).

Ancon, Canal Zone, Panama, 1909, (A. H. Jennings), 1 ♀, *paratype,* (macr.).

Phalangopsinae

GROUP LUZARAE

We have recently revised the present group [13] and have consequently noted below only the references and Panamanian records of the species which should be included in the present study.

Lerneca varipes Walker

1869. *Lerneca varipes* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 72. [♂, Amazon Region.]

France Field, Canal Zone, July 7 and August 18, 1920, (M. Hebard; in leaf litter on bare ground under palms in swamp area), 2 ♂, 1 ♀, 1 juv. ♂, 1 juv. ♀, (♀ macr.).

Gatun, C. Z., July 17 to 23, 1916, (D. E. Harrower), 1 ♀.

Tabernilla, C. Z., (A. Busck), 2 ♂, 1 ♀, (all macr.).

Gold Hill, C. Z., November 14, 1913, (M. Hebard; under heavily vine-covered bushes), 1 juv. ♀.

Corozal, C. Z., November 17, 1913, (M. Hebard; on ground under vines in blackish decaying leaf litter), 1 ♀, (small, brachypt.).

Gulf of San Blas, Colon, July, 1922, (D. E. Harrower), 1 ♂, [A. N. S. P.].

[13] Trans. Amer. Ent. Soc., LIV, pp. 1 to 56, (1928).

In this species the auditory foramina of the inner (cephalic) faces of the cephalic tibiae are decidedly larger than those of the outer (caudal) faces. These auditory foramina are considerably smaller in the brachypterous than in the macropterous females.

These records define the known northern limit of distribution of *varipes*. It is probably widely distributed over northern South America, as a large series of the species is before us from the Island of Trinidad.

Gryllosoma esau Hebard

1927. *Gryllosoma esau* Hebard, Trans. Amer. Ent. Soc., LIV, p. 25; pl. 3, fig. 2, pl. 4, fig. 1. [♂, ♀; Gatun and Porto Bello, Panama.]

This remarkable species, hairy and very dark in general coloration with distal joints of the palpi white, is known only from the originally described series of two males, three females and twelve immature individuals. We, however, also described a very closely related species from the Colombian Chocó.

Prosthama tessellata Hebard

1928. *Prosthama tessellata* Hebard, Trans. Amer. Ent. Soc., LIV, p. 34; pl. 4, fig. 2, pl. 5, fig. 3, pl. 6, fig. 2. [♂, ♀: La Emilia, Vesta Farm and Pandora Farm, Costa Rica; Gatun and Porto Bello, Panama.]

This small cricket, found in the dead leaves beneath the forest growth, is known from Panama from a single adult female and four immature individuals.

Luzara rufipennis Walker

1869. *Luzara rufipennis* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 103. [♂, Colombia.]

The single female from La Chorrera, Panama, which we have recorded, shows that this large, glabrous species reaches this region from northern South America.

Amusodes festae (Giglio-Tos)

1897. *A* [*musus*] *festae* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 301, p. 6. [♀; Punta di Sabana, Darien, Panama.]

At the time we recorded this species from Andagoya in the Colombian Chocó and from Gatun, Porto Bello and Gold Hill, Panama, we pointed out the fact that *Amusus* is a synonym of *Luzara*, these genera having been based on the same species.

GROUP HETEROGRYLLI

Eugryllina veraguae Hebard

1928. *Eugryllina veraguae* Hebard, Trans. Amer. Ent. Soc., LIV, p. 88, pl. 14, fig. 1, pl. 17, figs. 1 and 2. [♀: La Emilia and Pacayas, Costa Rica; Porto Bello, Panama.]

This species is known from Panama from the unique type. We have recently described another species of the genus from the Santa Marta Region of Colombia.

Acla[14] **crassicornis** (Saussure)

1878. *H[eterogryllus] crassicornis* Saussure, Mém. Soc. Phys. His. Nat. Genève, XXV, p. 417. [♂, Venezuela.]

Barro Colorado Island, Gatun Lake, Canal Zone, 1924, (J. C. Bradley), 2 ♀.

This species has previously been recorded from the Cianati and Lara Rivers in Darien. It is known from Nicaragua to Venezuela.

Aclodes nicuesa Hebard

1927. *Aclodes nicuesa* Hebard, Trans. Amer. Ent. Soc., LIV, p. 95, pl. 14, figs. 1 to 3. [♂, ♀: Carrillo, Costa Rica; Gatun, Barro Colorado Island, Rio Chilibrillo and Porto Bello, Panama; Andagoya, Colombia.]

This species, in general closely resembling *Acla crassicornis* (Saussure), but differing widely in the facial markings, tegminal venation and spurs of the caudal tibia, is known only from the material originally discussed.

Numerous arched veins in the speculum of the male tegmina are found elsewhere only in the still more highly specialized genus *Paragryllus* Guérin.

GROUP AMPHIACUSTAE

Amphiacusta phalangium Saussure

1874. *Amphiacusta phalangium* Saussure, Miss. Sci. Mexique, Rech. Zool., Orth., p. 450. [♂, Central America (later given as Gautemala).]

Gatun, Canal Zone, July 28 to August 5, 1916, (D. E. Harrower), 1 large juv. ♂, 1 large juv. ♀.

Barro Colorado Island, Gatun Lake, C. Z., 1924, (J. C. Bradley), 1 ♀.

[14] Described by the author, Trans. Amer. Ent. Soc., LIV, p. 91, (1928).

Though this insect differs from all other known species of *Amphiacusta* in the extreme slenderness and elongation of the limbs, median tibia armed distad with two spines and first corde (post-anal vein of Saussure) without a branch, we believe that, though an aberrant type, it is not sufficiently advanced to warrant generic or even subgeneric recognition.

The broad, not rostrate fastigium agrees best with the Mexican species of the genus, but the caudal tibiae are armed as in the West Indian species (which include the genotype, *annulipes* (Serville)) with four (not five or six) alternating pairs of spines. Though the West Indian species all have proportionately more elongate limbs than those from Mexico, nearer affinity to the latter is plainly shown by *phalangium*.

Oecanthinae

Oecanthus varicornis Walker

1869. *Oecanthus varicornis* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 94. [♂, Mexico.]

Panama, (E. Bethel), 1 ♂, [U. S. N. M.].

Gatun, Canal Zone, July 28 to August 5, 1916, (D. E. Harrower), 1 juv. ♂.

This insect was previously known from Sinaloa and Vera Cruz, Mexico, to Bugaba, Panama.

The male here recorded is small, measuring; length of tegmen 11.4, greatest width of tegminal dorsal field 4.3 mm.

Oecanthus californicus Saussure [15]

1874. *Oecanthus californicus* Saussure, Miss. Sci. Mexique, Rech. Zool., Orth., p. 462. [♂, California.]

Las Sabanas, 1924, (N. Banks), 1 ♂.

Taboga Island, July 4, 1907, (A. Busck), 1 ♂.

These are small and very pale individuals with head and antennae uniformly yellowish. Their tegminal measurements are; length 11 and 12.8, width of dorsal field 5.3 and 6.1 mm., the width divided by the length being .481 and .476.

In the southwestern United States and through Mexico to Costa Rica the species developes a large and richly colored condition.

This insect is now known from Colorado and Oregon south to Panama.

[15] For a masterly study of this species see Fulton, Oregon Coll. Agr. Exp. Sta., Bull. 229, pp. 11 to 20, figs. 2D and E, 7A to I, 8A to F and H, (1926).

TRIGONIDIINAE

Anaxipha pulicaria (Burmeister)

1838. *Gr[yllus] pulicarius* Burmeister, Handb. Ent., II, Abth. 2, pt. 1, p. 732. [Jamaica.]

France Field, Canal Zone, July 7 and August 18, 1920, (M. Hebard; moderate numbers in grasses of open spots in swamp area), 3 ♂, 6 ♀, (1 ♀ caudate).

Gatun, C. Z., July 17 to 23, 1916, (D. E. Harrower), 4 ♂, 6 ♀, 2 juv., (1 ♂ caudate).

Frijoles, C. Z., July 10, 1924, (N. Banks), 1 ♂, 1 ♀, (♀ caudate).

Barro Colorado Island, Gatun Lake, C. Z., June 24 and July 13, 1924, (N. Banks), 1 ♂, 1 juv.

Guamina, Rio Chagres, March 4, 1922, (G. H. H. Tate), 4 ♂.

Tabernilla, C. Z., May 14 to July 21, 1907, (A. Busck), 4 ♂, 5 ♀, (all caudate).

Corozal, C. Z., July 1912, 1 ♀, (caudate).

Ancon, C. Z., February 11, 1920, (J. Zetek), 3 ♂, 1 ♀; November 12 and 16, 1913, (M. Hebard; common in short grass in low open spot, taken by beating), 3 ♂, 8 ♀.

Old Panama, November 13, 1913, (M. Hebard), 1 ♂, 2 ♀, (♂ caudate).

Porto Bello, February 15, 1911, (E. A. Schwarz), 1 ♂; August 18 to 22, 1916, (D. E. Harrower), 1 ♀, (caudate).

Gulf of San Blas, Colon, July, 1922, (D. E. Harrower), 1 ♂, 3 ♀, (♂, 2 ♀ caudate).

We have nothing to add to our previous comments on this species,[16] which is known from southern Georgia to Bolivia.

Anaxipha stolzmannii (Bolivar)

1881. *Cyrtoxiphus stolzmannii* Bolivar, Anal. Soc. Espanola Hist. Nat., XX, p. 475. [♀; Palma [, Ecuador].]

France Field, Canal Zone, July 7, 1920, (M. Hebard; occasional in grasses particularly near small plant clusters, in open spots in swamp area), 2 ♂, 2 ♀, 1 juv. ♀, (caudate, but 1 ♂ very slightly so).

Gatun, C. Z., July 8, 1920, (M. Hebard), 1 ♀, (very slightly caudate); July 12 to 15, 1916, (D. E. Harrower), 1 juv.

Ancon, C. Z., February 11, 1920, (J. Zetek), 1 ♂, 1 ♀, (caudate).

This species is known from Cuba and in continental America from Costa Rica to Bolivia.

[16] Proc. Acad. Nat. Sci. Phila., LXXVI, p. 232, (1924).

Anaxipha hirsuta new species

This species shows decided similarity to *A. minuta* (Linnaeus) in contour, with coloration nearer that of *A. stolzmannii* (Bolivar). With the much smaller South American *A. esau* Rehn it is distinguished from all other known forms of the genus by the hairy covering of the tegmina.

Type: ♂; France Field, Canal Zone, Panama. July 7, 1920. (M. Hebard.) [Hebard Collection, Type No. 1104.]

Size rather large, form medium for the genus. Head with eyes prominent, protruding. Palpi comparatively short, the fifth joint evenly expanding to its very weakly oblique apical truncation, with diameter there slightly over half the length of the joint, which dimension is slightly less than the ocular width. Pronotum evenly widening caudad and there about twice as broad as its length. Tegmina well surpassing apex of abdomen and moderately broad, slightly broader than in *minuta*, the exposed dorsal surfaces thickly and evenly supplied with very minute hairs. Head, pronotum and limbs more hairy than usual. Wings strongly caudate (in this phase averaging slightly less strongly caudate than in *minuta*, but individuals are before us with wings projecting a very brief distance beyond tegmina). Concealed genitalia apparently not intricate, the minute apices of the genital valves projecting briefly on each side of the slightly stouter median projection of the caudal margin of the subgenital plate. Cephalic tibiae much as in *minuta*; comparatively short and stout, the proximal enlargement not very strong but narrowing so gradually distad that it extends over more than the proximal half; large oval auditory foramina present on both faces. Caudal femora medium. Caudal tibiae with spines strongly alternating, of medium length, the longest about equalling the length between their bases. Caudal metatarsus slender, the last two joints fully three-quarters as long, the longest tibial spur two-thirds the metatarsal length.

Allotype: ♀; Barro Colorado Island, Gatun Lake, Canal Zone, Panama. April 2, 1924. (J. C. Bradley.) [Hebard Collection.]

Generally similar to this sex of *minuta* except that the entire exposed dorsal surfaces of the tegmina are hairy, as in the male; the veins moderately pronounced and regular, the cross-veinlets not decided but distinct. Wings strongly caudate. Ovipositor much as in *minuta*, differing only in being slightly longer with thickening slightly more distal; moderately elongate, curved evenly dorsad, swelling weak, situated slightly before end of proximal three-fifths, the dorsal valves there with three small

nodes on each side, the dorsal margin alone serrate, showing only very weak obliquity to the acute apex in distal third of portion beyond swelling, which is scarcely wider than proximal portion of shaft. Subgenital plate with a very fine, brief, meso-distal cleft.

General coloration ochraceous-buff, paler on tegmina and wings. Last joint of palpi weakly suffused distad. Occiput and disk of pronotum to near its caudal margin tinged with brown, the bases of the heavier hairs in the paler caudal strip and on the lateral lobes also brown. Face immaculate except in intensive individuals, where two fine lines of dull maroon, briefly separated below the median ocellus, curve ventro-laterad parallel to the ventral margins of the antennal scrobes and a few flecks of the same appear also below the eyes and on the mouthparts. The limbs are in all immaculate, no darkening occurring at the bases of the spines or at their apices.

Length of body ♂ 6.5, ♀ 6; length, including wings ♂ 10.1, ♀ 10.2; length of pronotum ♂ .92, ♀ 1.13; total caudal width of pronotum ♂ 1.5, ♀ 1.7; length of tegmen ♂ 5.9, ♀ 5.8; width of dorsal fields of male tegmina, when folded 2.8; length of exposed portion of wings ♂ 3.2, ♀ 3.4; length of caudal femur ♂ 5.1, ♀ 5.2; length of longest caudal tibial spine ♂ .59, ♀ .61; length of caudal metatarsus ♂ .92, ♀ .92; length of ovipositor 2.1 mm., (by micrometer). The Tabernilla males show the extremes in size of the series, with length, including wings, 9.8 to 11.1 mm.

Specimens Examined: 9; 7 males and 2 females.

Guaimas District, Tela Division, Honduras, May 10, 1922, (T. H. Hubbell), 1 ♂, (intensive coloration, caudate), [Univ. of Michigan].

Cacao, Trece Aguas, Alta Vera Paz, Guatemala, March 23, 1 ♀, (very briefly caudate), [Hebard Cln.].

Great Falls, Rio Pis Pis, near Eden, Segovia, Nicaragua, May 26, 1922, (W. Huber), 1 ♂, (caudate), [A. N. S. P.].

France Field, Canal Zone, Panama, July 7, 1920, (M. Hebard; in grasses of open spots in swamp area), 1 ♂, *type*, (caudate).

Frijoles, C. Z., July 20, 1924, (N. Banks), 1 ♂, *paratype*, (very briefly caudate).

Taberilla, C. Z., May 13 and July 20, 1907, (A. Busck), 2 ♂, *paratypes*, (caudate).

Barro Colorado Island, Gatun Lake, C. Z., April 2, 1924, (J. C. Bradley), 1 ♀, *allotype*, (caudate).

Aracataca, Magdalena, Colombia, August 11, 1920, (M. Hebard; in broad-leaved vine tangle in open spot in lofty forest), 1 ♂, (very briefly caudate).

Anaxipha championi (Saussure)

1897. *Cyrtoxiphus championi* Saussure, Biol. Cent.-Amer., Orth., I, p. 236, pl. 11, fig. 41. [♂; Bugaba, Panama.]

1918. *Anaxipha fistulator* Rehn, Proc. Acad. Nat. Sci. Phila., 1918, p. 225, pl. 2, figs. 63 to 66. [♂; Igarapé-assú, Pará, Brazil.]

Lack of Central American material of *championi* led to the synonym *fistulator*, Costa Rican material of *A. minuta* (Linnaeus) at that time having been placed in the collection incorrectly under the name *championi*. The features given to separate *fistulator* from *championi* are, therefore, actually those which distinguish *championi* from *minuta*.

Barro Colorado Island, Gatun Lake, Canal Zone, July 15 and 19, 1924, (N. Banks), 3 ♂, (caudate).

Additional material of this species is before us from Costa Rica and localities on the Amazon from Pará to Teffe.

Species of extremely close relationship are the South American *stramenticia* Rehn and *fragilis* Hebard.

Anaxipha gracilis (Scudder)

1869. *Trigonidium gracile* Scudder, Proc. Boston Soc. Nat. Hist., XII, p. 331. [♀; Rio Napo [Ecuador or Peru].]

Saussure's *Cyrtoxipha azteca* and *tibialis* have been placed by us as synonyms of this species [17].

Gatun, Canal Zone, July 17 to August 22, 1916, (D. E. Harrower), 2 ♂, 3 ♀.

Tabernilla, C. Z., April 27 to June 20, 1907, (A. Busck), 6 ♂, 12 ♀.

Barro Colorado Island, Gatun Lake, C. Z., April, 1924, (J. C. Bradley), 1 ♂, 2 ♀; April and May 3, 1926, (C. T. Greene; at light), 2 ♂, 1 ♀; June 22 to July 26, 1924, (N. Banks), 9 ♂, 15 ♀.

Cano Saddle, Gatun Lake, C. Z., May 3, 1923, (R. C. Shannon), 3 ♂, 1 ♀.

Porto Bello, August 18 to 21, 1916, (D. E. Harrower), 1 ♀.

Material is before us from Costa Rica to Brazil, but the species is known to occur as far north as Mexico.

Anaxipha tolteca (Saussure)

1874. *Cyrtoxipha tolteca* Saussure, Miss. Sci. Mexique, Rech. Zool., Orth., p. 471. [♂, ♀; Mexico.]

Rio Trinidad, March 25, 1912, (A. Busck), 3 ♂.

[17] Proc. Acad. Nat. Sci. Phila., LXXVI, p. 239, (1924).

Barro Colorado Island, Gatun Lake, Canal Zone, April, 1926, (C. T. Greene; at light), 1 ♂; June 23 and July 20, 1924, (N. Banks), 2 ♀.

Bella Vista, July 2, 1924, (N. Banks), 1 ♀.

This large and handsome species is known northward to the States of Vera Cruz and Sinaloa, Mexico.

We placed *C. angusticollis* Saussure as a synonym of this species in 1924. It has been recorded previously from the Volcano of Chiriqui and under the latter name from Bugaba, Panama.

We question the published South American records of *angusticollis*. The material so recorded from Brazil by Rehn in 1918 is before us, as well as Guianan specimens, and these represent a related but distinct species.

Anaxipha nitida (Chopard)

1912. *C[yrtoxipha] nitida* Chopard, Ann. Soc. Ent. France, LXXXI, p. 408, two text figs. [♀; Nouveau Chantier, French Guiana.]

Barro Colorado Island, Gatun Lake, Canal Zone, April 5, 1924, (J. C. Bradley), 2 ♂; July 15 to 25, 1924, (N. Banks), 3 ♂, 1 ♀.

Cano Saddle, Gatun Lake, C. Z., May 3, 1923, (R. C. Shannon), 1 ♀.

This magnificent little cricket has been recorded by us from Costa Rica to eastern Peru, and by Rehn from Pará, Brazil.

The broad white antennal annuli and white tips of the tegmina and wings are among the most distinctive features of its coloration.

Anaxipha platyptera Hebard

1928. *Anaxipha platyptera* Hebard, Trans. Amer. Ent. Soc., LIV, p. 101; pl. 14, fig. 2, pl. 17, fig. 4. [♂, ♀: Pozo Azul de Pirris, Costa Rica; Tabernilla, Barro Colorado Island and Rio Trinidad, Panama; Aracataca, Colombia.]

The small size, banded limbs and broad male tegmina serve to distinguish this species easily from the others of the genus known from Panama. That nineteen specimens were secured at Tabernilla by Busck indicates that the insect is at times probably quite abundant locally in Panama.

MACROANAXIPHA new genus

We erect this genus to include a single species, *Cyrtoxiphus macilentus* Saussure.

The outstanding differences from *Anaxipha* Saussure are the extremely slender form and caudal metatarsus nearly twice as long as the two distal joints and almost three times as long as the longest tibial spur.

To *A. stramenticia* Rehn nearest similarity is shown particularly in the elongate palpi with ultimate joint obliquely truncate, but in addition to the differences noted above, *macilenta* has the head more flattened between the less prominent and nearly horizontal eyes, the cephalic tibiae more gradually enlarged proximad and the speculum of the male tegmina fully twice as long as broad. Thus the head in *Macroanaxipha* shows a tendency toward *Cyrtoxipha* Brunner, though it is only in this single feature that closer agreement with that genus is shown.

Macroanaxipha macilenta (Saussure) (Pl. XXV, fig. 3.)

1897. *Cyrtoxiphus macilentus* Saussure, Biol. Cent.-Amer., Orth., I, p. 235, pl. 11, fig. 45. [♀; Bugaba, Panama[18].]

1905. *Cyrtoxipha granadensis* Rehn, in Baker, Invertebrata Pacifica, I, p. 80. [♀; Granada, Nicaragua.]

Comparison of the type of *granadensis* with the other material now at hand gives convincing proof of the synonymy indicated above. Saussure's figure of the ovipositor is heavy, exaggerated and carelessly drawn. The ovipositor in Rehn's specimen, as in a Panamanian female now before us, has both dorsal and ventral margins exceedingly finely serrulate distad.

Tabernilla, Canal Zone, May 17, 1907, (A. Busck), 1 ♂.
Barro Colorado Island, Gatun Lake, C. Z., April 2, 1924, (J. C. Bradley), 1 ♀.

We have also before us a male from Eden, Nicaragua, and one from Aracataca, Magdalena, Colombia, these localities defining the known limits of distribution.

The general coloration of this extremely fragile cricket is pale buffy, the tegmina showing a faint greenish tinge in the best preserved specimen.

The tegmina of the previously unknown male measure; length 5.1, width of dorsal fields 1.7 mm.

[18] It is probable that the "Var. *gracilis*", based on a female from Teapa, Tabasco, Mexico, represents a species of *Anaxipha*.

Symphyloxiphus pictus (Saussure)

1897. *Cyrtoxiphus pictus* Saussure, Biol. Cent.-Amer., Orth., I, p. 237. [♂, Panama.]

Gatun, Canal Zone, April 7, 1911, (A. H. Jennings), 1 ♀, (caudate); July 17 to August 22, 1916, (D. E. Harrower), 1 ♂, 1 juv. ♂ [19].

Frijoles, C. Z., July 10, 1924, (N. Banks), 1 ♂, 1 ♀.

Tabernilla, C. Z., April 27, 1907, (A. Busck), 2 ♀, 1 large juv. ♂.

Guamina, Rio Chagres, March 4, 1922, (G. H. H. Tate), 18 ♂, 20 ♀.

The previously unknown female of this very handsome species normally (a brachypterous condition) has the tegmina coriaceous, shining metallis blue-black, convex, no longer than and fitting closely to the abdomen, with many, closely placed, regular, longitudinal veins in the dorsal fields.

One of the twenty females here recorded is, however, macropterous. In it the tegmina show less convexity and are transparent ochraceous buff tinged with orange toward the orange pronotum as in the males, while the strongly caudate wings are prouts brown. All other characters prove the specific identity of this individual, demonstrating that macropterism and brachypterism in the same species is sometimes accompanied by striking differences in both texture and coloration of the tegmina.

Large auditory foramina are present only on the caudal faces of the cephalic tibiae in the brachypterous series, on both faces of the cephalic tibiae in the macropterous individual [20].

The closely related *S. magnificus* Rehn, found in Costa Rica, is readily distinguished by having one instead of two longitudinal black bands on the external faces of the caudal femora.

Symphyloxiphus nigrellus new species (Pl. XXV, figs. 4 and 5.)

This, much the smallest known Central American Trigonidiid, is easily recognized by its very small size, blackish head, pronotum and tegmina and immaculate buffy antennae, palpi and limbs.

[19] Taken on July 17th.

[20] This feature has been noted for other species of the genus by Rehn in 1917, (Trans. Amer. Ent. Soc., XLIII, p. 361).

It is nearest the South American *S. pulex* Rehn, but may be distinguished by the shorter palpi and pale cephalic and median femora. The male also has much less ample tegmina of decidedly darker coloration. In *nigrellus* the female tegmina have no supplementary veins between the principal veins of the dorsal fields; in *pulex* these are moderately developed and in *S. abbreviatus* (Brunner) they are decided.

Type: ♂; Aurora Farm, Estrella Valley, Costa Rica. September 11, 1923. (J. A. G. Rehn.) [A. N. S. P., Type No. 5437.]

Size very small, form comparatively robust, limbs short for the group. Head with eyes moderately prominent, large but not strongly protruding, almost vertical. Palpi short, the fifth joint expanding evenly and considerably to the transversely truncate apex, which is about three-fifths as wide as the length of the joint. Pronotum widening gently caudad, distinctly less transverse than in *pulex*. Tegmina of normal form in genus, surpassing abdomen and of moderate width, with lateral margins parallel. Wings absent. Subgenital plate truncate distad, with a minute rounded acute-angulate median projection. Cephalic tibiae gradually and not decidedly expanding in proximal portion, this expansion greater, however, than in *pulex*; there with a large tympanum on caudal face and a smaller one on cephalic face [21]. Caudal tibiae with three strongly alternating pairs of spines, the longest equalling the length between their bases. Caudal metatarsus of medium length, the longest tibial spur distinctly over half its length.

Allotype: ♀; Guácimo, Costa Rica. August 23, 1923. (J. A. G. Rehn.) [A. N. S. P.]

Agrees closely with male except as follows. Tegmina not surpassing the apex of abdomen and their convexity fitting it closely; veins well developed and regular, with no adventitious veins between but with a few delicate cross-veinlets in dorsal field [22]. Ovipositor rather short and stout, the moderate curvature dorsad taking place only in proximal and distal portions, the thickening at end of proximal two-thirds and weakly indicated only on dorsal margin, the margins thence evenly converging to the

[21] No difference is shown in this feature by the single macropterous female before us.

[22] Thus in form the female is typical, but its tegminal venation is that normal in *Anaxipha* Saussure. Though that character is one of the most valuable to distinguish females of the other species of *Symphyloxiphus* Rehn, *nigrellus* is plainly congeneric though disagreeing in that respect. In a strongly macropterous female the tegmina differ only in being slightly less convex.

acute apex and the dorsal margin showing no obliquity whatever, these margins microscopically serrulate distad, the extent of such much greater on the dorsal margin. Subgenital plate bilobate, with a very narrow meso-distal cleft.

Coloration as described above. A minute buffy fleck toward eye from each minute buffy lateral ocellus. Proximal antennal joint suffused with brown, often heavily so. Caudal margin of pronotal disk with traces of buffy flecks laterad, these normally very obscure and sometimes almost obsolete. Tegmina of female glossy and deeper blackish brown than those of male. Caudate wings, when present, uniform very dark brown. Ovipositor very slightly more russet than the immaculate buffy limbs.

Length of body ♂ 4.2, ♀ 4.1; length including tegmen ♂ 4.6, ♀ 4.1; length including wings of caudate ♀ 6.5; length of pronotum ♂ .8, ♀ .86; total caudal width of pronotum ♂ 1.3, ♀ 1.1; length of tegmen ♂ 3.3, ♀ 3.1 (caudate ♀ 3.2); width of tegminal dorsal fields ♂ 1.6; length of exposed portion of wings of caudate ♀ 3.4; length of caudal femur ♂ 3.8, ♀ 3.8; length of longest caudal tibial spine ♂ .38, ♀ .42; length of caudal metatarsus ♂ .8, ♀ .8; length of ovipositor 1.68 mm., (by micrometer).

Specimens Examined: 6; 3 males and 3 females.

Guácimo, Costa Rica, elevation 600 feet, August 23, 1923, (J. A. G. Renn; beaten from foliage of weeds in Balsa plantation), 1 ♀, *allotype*, [A. N. S. P.].

Guapiles, Costa Rica, elevation 984 feet, August 19 and 20, 1923, (J. A. G. Rehn; in low weedy growth of potrero), 1 ♂, 1 ♀ (macropterous), *type* and *paratype*, [A. N. S. P.].

Aurora Farm, Estrella Valley, Costa Rica, elevation 100 feet, September 11, 1923, (J. A. G. Rehn; rare in grass of potrero), 2 ♂, *type* and *paratype*, [A. N. S. P.].

Guamina, Rio Chagres, Panama, March 4, 1922, (G. H. H. Tate), 1 ♀, [Hebard Cln.].

Cyrtoxipha gundlachi Saussure

1874. *Cyrtoxipha gundlachi* Saussure, Miss. Sci. Mexique, Rech. Zool., Orth., p. 373. [♂, ♀; Cuba and southern United States.]

France Field, Canal Zone, July 7, 1920, (M. Hebard; from foliage of swamp vines and bushes), 1 ♂.

This species is known to range northward to Sinaloa, Mexico, appearing also in Jamaica, Cuba and peninsular Florida. The South American records may apply to this or to closely related species described from that continent.

The insect is rare in collections from continental tropical America. This is probably due to the fact that it is more thamnophilous and arboreal than the species of *Anaxipha*.

Dried material is light yellowish buff, but in life the insect is a most delicate light green.

CHOPARDINA[23] new genus

This genus is erected to include the remarkable species *Metioche americana* Chopard. It is nearest the Old World *Metioche* Stål differing in the evenly horizontal, deplanate occiput and fastigium which forms a very sharply rounded rectangle with the face, the horizontal (not nearly vertical) eyes and the very short and greatly expanded ultimate palpal joint.

It is evident that the general coloration is light green in life and this, as in *Cyrtoxipha* Brunner, may also be used as a generic character.

The nearest American genus is *Cyrtoxipha*, that genus differing in the fully developed stridulating field of the male tegmina, shorter eyes which are more protuberant, evenly conical last joint of palpi, less broadly convex ventro-cephalic angle of pronotal lateral lobes and presence of large auditory foramina on both faces of the cephalic tibiae [24]. In *Chopardina* the cephalic tibiae have large auditory foramina on the cephalic faces but large depressions, with or without small auditory foramina, on the caudal faces [25]. The tegminal venation is similar in both sexes, the veins longitudinal with delicate cross-veinlets indicated only in the portion of the sinistral tegmen concealed when at rest, the males entirely lacking stridulatory development.

Chopardina americana (Chopard)

1912. *Metioche americana* Chopard, Ann. Soc. Ent. France, LXXXI, p. 406, 4 text figs. [♂; La Forestière, French Guiana.]

Barro Colorado Island, Gatun Lake, Canal Zone, March 26 to April 2, 1924, (J. C. Bradley), 1 ♂, 1 ♀.

[23] Named in honor of our friend, Dr. Lucien Chopard, specialist on the Gryllidae.

[24] It is very possible that the auditory foramina of the caudal faces would disappear in brachypterous individuals, but in very large series of *Cyrtoxipha* before us all are strongly macropterous.

[25] It is to be noted that, when the auditory foramina disappear from one of the faces of the cephalic tibia in *Anaxipha* and *Symphyloxiphus*, this occurs on the cephalic and not the caudal faces.

The previously unknown female closely resembles the male. The ovipositor is very similar to that of *Cyrtoxipha gundlachi* Saussure, but the rectangulate distal teeth are somewhat less heavy. This female measures; length of body 6.8, total length including wings 11.3, length of tegmen 5.7, exposed length of wing 4, length of caudal femur 5.4, length of ovipositor 2.1 mm.

Phylloscyrtus elegans Guérin

1844. *Phylloscyrtus elegans* Guérin, Iconogr. Regne Anim., Ins., p. 333. [♂, Mexico.]

We have recently placed *Thamnoscirtus* as a synonym of *Phylloscyrtus* and *costatus* and *montanus* as synonyms of *elegans* [26].

France Field, Canal Zone, July 7 and August 18, 1920, (M. Hebard; scarce in heavy foliage on high ground and few in vine tangles in swamp area), 5 ♂.

Gatun, C. Z., July 12 to August 5, 1916, (D. E. Harrower), 3 ♀; September 1, 1909, (A. H. Jennings), 2 ♀.

Fort Sherman, C. Z., July 3, 1924, (N. Banks), 1 ♀, 1 juv. ♂.

Tabernilla, C. Z., April 27 to July 31, 1907, (A. Busck), 2 ♂, 1 juv. ♂.

Zone limit five miles west of Empire, November 14, 1913, (M. Hebard; in vine tangle on ground in open spot of forest), 1 ♂, 1 ♀.

Panama City, November 13, 1913, (M. Hebard), 1 ♂.

Porto Bello, February 28, 1911, (A. Busck), 2 ♀.

Gulf of San Blas, July, 1922, (D. E. Harrower), 1 ♂.

An interocular band of darker brown is very weak or obsolete in the majority of the present series. A few show two broad longitudinal bands of dark brown on the pronotal disk, these likewise very weak or obsolete in the majority of the present series except their caudal extremities, which persist as two large suffusions of very dark brown in even the most recessive examples.

Saussure supposed the synonymous *elegans* to be smaller than *P. cicendeloides* Gerstaecker, but the males of the present series show a length, including tegmina, ranging from 6.7 to 8 mm. We believe, therefore, that his record of *cicendeloides* from Bugaba, Panama, is probably based on a large example of *elegans*.

[26] Trans. Amer. Ent. Soc., LIV, p. 103, (1928).

The species is now known from Panama and Colombia, its absence from large Central American collections secured north of Panama leading us to believe that the type was incorrectly labelled "Mexico". There is no other record of the occurrence of the genus, as now restricted, north of northern Panama.

Eneopterinae

Eneoptera surinamensis (DeGeer)

1773. *Gryllus surinamensis* DeGeer, Mém. Hist. Nat. Ins., III, p. 519, pl. 43, fig. 1. [♀, Surinam.]

1839. *Platydactylus vicinus* Serville, Hist. Nat. Ins., Orth., p. 365. [♂; Buenos Aires, Argentina[27].]

1897. *Paraeniopterus elegans* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, No. 301, p. 8. [[Juv.] ♀; Punta di Sabana, Darien[, Panama].]

Between the humeral and discoidal veins a large and conspicuous shining black spindle-shaped area is found on the female tegmina distad, this is lacking in the male sex and led to the description of *vicina*, a name synonymized by Saussure in 1878, but resurrected by Kirby in 1906.

Comparison of the immature here recorded from David and other immature examples in the Philadelphia Collections with Giglio-Tos' description gives ample proof of the synonymy of *elegans*. Three times in the same paper Giglio-Tos proposed synonymic names through failure to recognize immature Gryllids as such.

David, Chiriqui, August 10, 1922, (D. E. Harrower), 1 medium small juv. ♂, (dorsal surface with a broad percurrent buffy stripe).

Zone limit five miles west of Empire, November 14, 1913, (M. Hebard; in tangle of vines lying on ground in open spot in forest), 1 large juv. ♂, (dorsal surface not striped).

This species is known from Nicaragua to Paraguay.

PONCA new genus

This genus is close to *Eneoptera* Burmeister but differs strikingly in the features given below. The genotype, *P. venosa* here described, is the only species known.

Head more declivent between eyes with fastigium not widen-

[27] We question this record. The species probably does not occur south of the tropical forests.

ing beyond the lateral ocelli and its lateral margins broadly instead of sharply rounded. Ocelli very small, forming a strongly transverse triangle. Lateral lobes of pronotum with ventro-cephalic angle very sharply rounded at less than a rightangle. Tegmina and wings fully developed but less elongate than in *Encoptera;* male with cordes very strongly convex, speculum reduced but irregular in outline with a single undulating vein across it, interval between humeral and discoidal veins more conspicuous, broader and shorter; female with very numerous veinlets of dorsal field forming regular areas with the veins as in *Encoptera*, but these areas more elongate and the venation all more elevated, mediastine vein straight and separated from humeral vein by a decidedly greater distance, the spindle-shaped area formed between the latter and the discoidal vein distad much smaller and not of different color or structure. Limbs heavier and much shorter, otherwise similar except that the cephalic tibiae are not at all inflated. Auditory foramina of the latter large and elliptical on caudal face, represented by a narrow ventral slit on the cephalic face. Caudal tibiae armed with numerous minute teeth and four pairs of alternating spines of which the internal are the longer and curved; of the three pairs of distal spurs the longest is the median internal. Metatarsus moderately elongate with a dorso-external row of teeth, the internal of the apical spurs nearly as long as the terminal joint.

Ponca venosa new species (Pl. XXIV, figs. 2 and 3.)

This handsome brown cricket is distinguished particularly by the raised venation of the dorsal fields of the tegmina in both sexes.

Type: ♂; Vesta Farm, Estrella Valley, Costa Rica. September 13, 1923. (J. A. G. Rehn.) [A. N. S. P., Type No. 5440.]

The following characters are given in addition to those noted in the generic description. Size medium, form moderately robust, limbs short. Eyes slightly more protuberant than in *Encoptera surinamensis* (DeGeer). Ocelli forming a triangle about twice as wide as high, the median transverse but no longer than the others. Pronotum expanding very slightly caudad, the disk with caudal margin faintly bi-undulate. Tegminal venation of same general type found in *surinamensis,* but differing strikingly as noted above. Wings caudate (in series falling slightly

short of apices of caudal femora to slightly surpassing these). Supra-anal plate broadly convex distad. Subgenital plate simple, scoop shaped. Longest, median internal, spur of caudal tibiae nearly as long as the metatarsus, the dorso-internal two-thirds its length, the ventro-internal and medio-external equal and slightly shorter than the dorso-internal, the ventro-external much smaller and the dorso-external smallest.

Allotype: ♀ ; same data as type. [A. N. S. P.]

Similar to male, differing as follows. Size larger. Tegmina with seven oblique veins in dorsal field on each side more distinctly raised than the other veins and veinlets. Ovipositor much shorter than caudal femur, curved gradually dorsad to the apex, the sides of which are smooth, moderately enlarged, its shape lanceolate with dorsal margin distad very feebly and not closely serrulate [28]. Subgenital plate simple, short, scoop-shaped, truncate.

General coloration mottled brown, like dead leaves. Head with occiput dark, showing four very fine longitudinal lines; face paler, a broad subocular dark bar on each side. Palpi buffy brown with dark brown annuli. Pronotum buffy brown mottled with darker except narrowly along the lateral margins, the lateral lobes below this more solidly darker. Male tegmina with a dark suffusion in anal field toward angulation of anal vein and area between humeral and discoidal veins in lateral fields conspicuously blackish brown, the homologous area in the female tegmina, which in that sex lies between the mediastine and humeral veins, dark brown but not as striking. Femora buffy brown, thickly flecked and suffused with dark brown, the caudal femora paler internally but with a meso-distal suffusion on their external faces, the ventral carinae buffy with elongate blackish flecks. Cephalic and median tibiae buffy brown with three dark annuli which dorsad are very decided, blackish; caudal tibiae darker brown with buffy spines. Metatarsus and ultimate tarsal joint dark brown with a median buffy annulus. Ovipositor buffy with a median line and apex chestnut.

Size variation in the adults is inconsiderable, the described pair measure: length of body ♂ 16 [29], ♀ 17; length of pronotum ♂ 2.6, ♀ 2.9; caudal width of pronotal disk ♂ 4, ♀ 5.1; length of tegmen ♂ 11.8, ♀ 12; greatest (proximal) width of dorsal tegminal fields ♂ 4.8; exposed length of wings ♂ 6.8, ♀ 5.7; length of caudal femur ♂ 14.1, ♀ 15.5; greatest width of caudal femur ♂ 4.1, ♀ 5; length of ovipositor 10.7 mm.

[28] In some specimens this margin is smooth, apparently due to abrasion.

[29] Estimated for normal abdominal position.

Specimens Examined: 22; 6 males, 9 females and 7 immature individuals.

Limon, Costa Rica, (M. A. Carriker, Jr.), 2 ♂, *paratypes*, [Hebard Cln.].

Juan Viñas, Costa Rica, March, 1902, (L. Bruner), 2 ♀, *paratypes*, [Hebard Cln.].

Guápiles, Costa Rica, February 26, 1903, 1 ♀, *paratype*, [Hebard Cln.].

La Emilia, near Guápiles, Costa Rica, 1000 feet, August 20, 1923, (J. A. G. Rehn; numerous in undergrowth, chiefly in shade, very few adults), 1 ♂, 2 ♀, *paratypes*, 2 large juv. ♂, 2 large juv. ♀, [A. N. S. P.].

Vesta Farm, Estrella Valley, Costa Rica, 200 feet, September 11 and 13, 1923, (J. A. G. Rehn; numerous on ground and in low growth of wet forest, adults scarce), 3 ♂, 3 ♀, *type*, *allotype* and *paratypes*, 1 large juv. ♂, [A. N. S. P.].

Barro Colorado Island, Gatun Lake, Canal Zone, Panama, July 30, 1924, (N. Banks), 1 ♀, [Mus. Comp. Zool.].

Porto Bello, Panama, August 18 to 21, 1916, (D. E. Harrower), 2 small juv., [Hebard Cln.].

Phyllogryllus hirsutus new species (Pl. XXIV, figs. 4 and 5.)

This species, also colored like dead leaves, is readily distinguished from the other known South American forms of the genus by the finely but very sharply annulate antennae, much shallower lateral lobes of the pronotum, oblique sectors of the tegmina very vaguely, broadly and irregularly defined by color, very short ovipositor and particularly conspicuous hairy covering of the limbs, the hairs on the caudal tibiae being as long as the spines.

The species shows the characteristic generic features of rounded head, small but moderately protuberant eyes, very short palpi, very ample tegmina, caudal tibial spurs short with dorso-internal the longest and short caudal metatarsus.

Type: ♀; Barro Colorado Island, Gatun Lake, Canal Zone, Panama. July 18, 1924. (N. Banks.) [Mus. Comp. Zool.]

Size medium large, form moderately robust; limbs normal, comparatively short but not very heavy. Head moderately hairy, with very small ocelli widely separated and placed in a transverse line; interantennal space slightly broader than the comparatively small proximal antennal joint. Palpi very hairy, with fifth (ultimate) joint slightly longer than fourth, very

strongly expanding, the distal oblique truncation intermediate in length between that of the dorsal and ventral margins. Pronotum hairy, the hairs numerous and elongate ventro-laterad; lateral lobes obliquely and strongly but broadly impressed, distinctly longer than deep, rounding evenly into the disk, only a little deeper cephalad than caudad, with ventro-cephalic angle broadly rounded at slightly more than ninety degrees. Tegmina very ample, broad and elongate, covered with a network of slightly raised veins and veinlets, the former forming in dorsal fields some very poorly defined oblique sectors; lateral fields with one distal branch from discoidal vein and (eight or nine) regular oblique branches from the mediastine vein preceded by (three or four) similar free veins. Wings briefly surpassing tegmina. Cephalic tibiae laterally flattened [30] and slightly broadening proximad, with oval auditory foramina of which that of the caudal faces is decidedly the larger. Caudal tibiae much more hairy than in *velutinus* with weaker teeth but longer six pair of spines [31]. Caudal metatarsus with three heavy teeth, one meso-external and a distal pair before the pair of spurs, of which latter the internal is as long as the metatarsus. Ovipositor very short [32], its apex horizontal, lanceolate; dorsal valves there granulate with ventro-external margin armed with large rounded teeth, ventral valves there with ventro-internal margins each armed with three spiniform teeth.

Head cinnamon brown with prouts brown suffusion on occiput, this portion feebly glabrous, face and genae decidedly glabrous. Pronotum prouts brown with many of the hairs grayish. Antennae light buff with very numerous proximal flecks followed by short, sharp annuli of blackish brown. Tegmina wood brown, with vague, very irregular, broad oblique areas suffused with warm sepia and minute flecks of dark brown along the intersection of the dorsal and lateral fields. Wings tinged with grayish buff, the apices ribbed with brown. Limbs wood brown covered with gray hairs, the femora very finely and weakly tessellate with darker brown, the caudal femora with genicular lobes and caudal tibiae at bases of spurs flecked with dark brown.

Length of body 13 [33], length of pronotum 3.8, caudal width of pronotal disk 4.9, length of tegmen 19.8, exposed length of

[30] Not also transversely thickened as in a male of *P. velutinus* (Walker) from British Guiana, in the Acadamy Collection, possibly a sexual feature.

[31] The two proximo-external spines are absent in the male of *velutinus* before us as well as in the female figured by Saussure as the synonymous *mortuifolia*.

[32] Decurved, very possibly due to drying.

[33] Decidedly shrivelled.

wing 2.7, length of caudal femur 12.5, greatest width of caudal femur 2.8, length of ovipositor 6.3 [34] mm.

Specimens Examined: 4; 1 female and 3 immature individuals.

La Emilia near Guapiles, Costa Rica, 1000 feet, August 12 and 14, 1923, (J. A. G. Rehn; in heavy and very wet forest), 1 juv. ♂, 1 juv. ♀, [A. N. S. P.].

Gatun, Canal Zone, Panama, (A. H. Jennings), 1 juv. ♀.

Barro Colorado Island, Gatun Lake, C. Z., Panama, July 18, 1924, (N. Banks), 1 ♀, *type*.

Diatrypa jansoni Saussure

1897. *Diatrypus jansoni* Saussure, Biol. Cent.-Amer., Orth., I, p. 259, pl. 13, fig. 4. [♂; Chontales, Nicaragua.]

Tabernilla, Canal Zone, May 1, 1907, (A. Busck), 1 ♀.

This specimen has the head and pronotum chestnut brown, but the latter becomes tawny on the disk. The palpi are brownish buff. It measures; length of body 7.8, length including wings 13, length of pronotum 1.9, length of tegmen 8.7, exposed length of wing 2.7, length of caudal femur 5.7, length of ovipositor 5.7 mm.

To this species *D. pallidelabris* Chopard is very closely related, the most striking difference being the contrastingly pale palpi and lower portions of the head in that insect. These species are closely related to the Mexican *D. tolteca* Saussure, *jansoni* differing mainly in its somewhat smaller size, more slender form, darker brown head and pronotum and narrower speculum of the male tegmina.

The distribution of *jansoni* is known to extend from Nicaragua to Ecuador [35] and French Guiana [36].

Diatrypa univittata new species (Pl. XXIV, fig. 6.)

This insect is very closely related to an undescribed Nicaraguan species before us, males of which show that in both sexes the structural agreement with *D. tolteca* Saussure is very close.

A pale band across the fastigio-facial protuberance finely margined with dark brown dorsad and a decided longitudinal band of dark brown on the external face of the caudal femora

[34] Estimated as straightened out.

[35] Hebard; Proc. Acad. Nat. Sci. Phila., LXXVI, p. 243, (1924).

[36] Chopard; Ann. Soc. Ent. France, LXXXI, p. 417, 2 text figs., (1912).

consequently constitute the most striking features of difference in *univittata.*

Type: ♀ ; Barro Colorado Island, Gatun Lake, Canal Zone, Panama. April 2, 1924. (J. C. Bradley.) [Hebard Collection, Type No. 1111.]

Size and form medium for this genus of small and slender species. Head and pronotum moderately hairy, the former with vertex deplanate, rounding into the face at very slightly over ninety degrees between the antennae, where its apical width is slightly less than that of a proximal antennal joint. Eyes moderately prominent. Palpi with fifth (distal) joint about as long as third, expanding very weakly to base of apical truncation, which occupies one-third the distance to base, thence showing no expansion and thus of a type similar to but less decidedly developed than that of the Guianan *D. annulicornis* Chopard. Pronotum broader than long, its caudal margin broadly convex mesad and showing feeble concavity on each side; lateral lobes very slightly deeper cephalad than caudad, the ventro-cephalic angles very broadly rounded, more so than the ventro-caudad angles, a broad oblique impression becomes strongest ventro-caudad. Tegmina very elongate and narrow, flattened dorsad, microscopically pilose, dorsal fields with regular veins and delicate straight cross-veinlets, forming elongate rectangles; lateral fields with three or four free veins, the mediastine vein with four branches. Cephalic tibiae becoming heavier proximad but hardly inflated, the auditory foramina almost hemi-elliptical, those of the cephalic faces the larger and more deeply inset. Caudal femora moderately stout, caudal tibiae with very numerous teeth, five pairs of spines and three pairs of spurs; dorso-internal spur the longest, half as long as the metatarsus, the medio-internal slightly longer than the longest spine. Caudal metatarsus of medium length, armed dorsad with four internal and one disto-external teeth. Ovipositor nearly as long as caudal femur, shaft straight but slightly reflexed near the knob-like apex; the external valves there with a bluntly tridentate internal margin and convex surface with a large blunt meso-distal tooth.

Head mikado brown, the mouthparts, palpi and antennae clay color with a buffy interocular bar which crosses the antennal scrobes just above the antennae and the apex of the fastigio-facial protuberance. Pronotum weak mikado brown deepening to warm sepia on lateral lobes. Tegmina and wings transparent tinged with tawny olive. Limbs clay color, the caudal femora becoming pale buff proximad and just beyond the basal portion with a broad longitudinal band of blackish brown, just below the median line, this band becoming more dilute distad. Caudal

tibiae with flecks of dark brown at bases of spines, the metatarsus light buff with apex clay color.

Length of body 8.1, total length including wings 14.7, length of pronotum 1.9, caudal width of pronotum 2.7, length of tegmen 9.3, total dorsal width of tegmina 3, exposed length of wing 3.3, length of caudal femur 7, width of caudal femur 1.9, length of ovipositor 6.1 mm.

Diatrypa championi Saussure

1897. *Diatrypus championi* Saussure, Biol. Cent.-Amer., Orth., I, p. 260, pl. 13, figs. 2 and 3. [♂; Bugaba, Panama.]

Barro Colorado Island, Gatun Lake, Canal Zone, July 17, 1924, (N. Banks), 1 ♀.

Ancon, C. Z., VIII, 6, 1921, (N. Banks), 1 ♀.

Without males from the Canal Zone we can not be certain of this determination as the female sex of *championi* has not been elsewhere recognized and we have before us material of two closely related species from Costa Rica and Colombia.

The females here recorded agree fully in ambisexual features with the description of *championi* except that minute annuli are present distad on the antennae. The ovipositor is extremely elongate for the genus, gradually curved dorsad with apex as described here for *D. univittata*. Length of body 11.7 and 11.3, total length including wings 17 and 15, length of tegmen 11.3 and 10.8, exposed length of wing 2.7 and 2.4, length of caudal femur 8.8 and 8.2, length of ovipositor 13.9 and 13.7 mm.

HAPITHOIDES new genus

This genus is erected to include a single new species, *H. insolitum* here described.

Of medium size, the tegmina of the male superficially suggest the type developed in *Ectecous* Saussure, but the speculum is crossed by a single transverse vein, while the venation of the lateral fields is complex. The head, moderately robust structure and short limbs suggest *Hapithus* Uhler, particularly in the female, but that sex is entirely apterous, a very rare condition in the Eneopterinae, to which subfamily it undoubtedly belongs. Further affinity to *Hapithus* is shown by the numerous spines of the caudal femora, dorso-internal spur the longest and metatarsus of medium length with a single row of teeth, but the cau-

dal tibiae have only a few teeth proximad of the spines and the second tarsal joint is even more weakly cordiform. The cephalic tibiae are not thickened proximad and have large oval auditory foramina, those of the caudal faces being the largest. The anal vein of the male tegmina and the numerous oblique veins are normal, not angled, these latter features of cephalic tibiae and male tegmina agreeing with *Diatrypa* Saussure.

The extremely short ovipositor has an unarmed apex, in this feature alone agreeing with the Eneopterites and not with the Podoscirtites.

Hapithoides insolitum new species (Pl. XXVI, figs. 1 and 2.)

The combination of characters shown by this species is very unusual, but we feel that it should be placed after *Diatrypa* Saussure and its allies and before *Paroecanthus* Saussure.

Type: ♂ ; Barro Colorado Island, Canal Zone, Panama. August 2, 1924. (N. Banks.) [Mus. Comp. Zool.]

Size medium, form moderately stout, limbs short. Head full, wider than cephalic portion of pronotum, deeper than long, hirsute, fastigio-facial protuberance moderately decided. Ocelli very small, arranged in a triangle twice as broad as high. Proximal antennal joint a full three-quarters width of fastigium at its apex. Palpi short, ultimate joint the longest, expanding evenly and gradually to the transverse, truncate apex, the diameter of which is slightly over half the length of the dorsal margin. Pronotum hirsute, broader than long, evenly narrowing cephalad, caudal margin straight; lateral lobes with ventro-cephalic angle rounded subrectangulate, the ventral margin obliquely ascending to the very broadly rounded ventro-caudal angle. Tegmina diaphanous with dorsal fields deplanate, broadly oval, reaching to near apex of abdomen, anal field greatly reduced and very narrow, oblique veins sinuous and seven in number, speculum transverse, its cephalic angle slightly over ninety degrees, its dextral cephalic margin feebly concave, its surface crossed by a single transverse, weakly arcuate vein; lateral fields with four free veins and mediastine vein with eight oblique branches the proximal of which are sinuous, mediastine, humeral and discoidal veins separated by shallow channels of about equal width. Wings absent. Supra-anal plate simple, deeply notched opposite cerci, thence transversely rectangulate with angles rounded. Subgenital plate simple, scoop-shaped. Caudal tibiae with eight pairs (or seven pair and one proximo-internal) of stout, rather short spines. Dorso-internal spur of caudal tibiae two-thirds

as long as the metatarsus, the latter armed with four (or three) dorso-external and one dorso-internal teeth.

Allotype: ♀; same data as type but taken June 25, 1924. [Mus. Comp. Zool.]

Agrees closely with male, differing as follows. Apterous. Mesonotum and metanotum as hairy as head and pronotum, the dorsal surface of the abdomen less strongly so. Ovipositor extremely short, notched at base of apical portion, which is not enlarged and has smooth margins to its acute apex. Subgenital plate small, short, transverse, broadly and weakly bilobate.

Head, antennae, palpi and limbs sayal brown, the occiput suffused with bister, this very weak in female. Pronotum bister, paler in female, with two areas of cinnamon on disk and ventral portions of lateral lobes sayal brown. Abdomen blackish brown, becoming paler proximad in apterous female. Male tegmina glassy, almost colorless but with distal margin brownish buff and with a large portion of anal field, central portion of first cordes and area between discoidal, humeral and median veins, including bases of branches from the latter, opaque blackish brown. Limbs with some minute flecks of dark brown, caudal femora with apices slightly darkened, caudal tibiae with large flecks of dark brown at bases of spines, caudal metatarsi buffy proximad and blackish brown distad.

Length of body ♂ 11.8, ♀ 13.2; length of pronotum ♂ 2.6, ♀ 2.7; caudal width of pronotal disk ♂ 3.7, ♀ 3.3; length of tegmen ♂ 7; total width of dorsal tegminal fields ♂ 5; length of caudal femur ♂ 9.2, ♀ 9.8; greatest width of caudal femur ♂ 3.4, ♀ 3.6; length of ovipositor 4 mm.

A male paratype, bearing the same data, but taken July 26, 1924, is in the author's collection.

Paroecanthus annulatus (Scudder)

1868. *Eneoptera annulata* Scudder, Proc. Boston Soc. Nat. Hist., XII, p. 140. [♀, Central America.]

We have recently pointed out [37] that, though material recorded from south of Mexico by Saussure as his *aztecus* probably represents this species, it is unwise at the present time to follow Kirby in placing that name as a synonym.

Tabernilla, Canal Zone, July 24, 1907, (A. Busck), 1 ♀.
Las Sabanas, July 7, 1924, (N. Banks), 1 small ♀.

A large series of *annulatus* is before us from Costa Rica and northern Colombia.

[37] Trans. Amer. Ent. Soc., LI, p. 308, (1925).

Paroecanthus podagrosus Saussure

1897. *Paroecanthus podagrosus* Saussure, Biol. Cent.-Amer., Orth., I, p. 264, pl. 13, figs. 7 to 11. [♂, ♀: Senahu, Guatemala; Bugaba and La Caldera, Panama.]

1912. *Paroecanthus vicinus* Chopard, Ann. Soc. Ent. France, LXXXI, p. 420, 4 text figs. [♂; St. Jean du Maroni and Nouveau Chantier, French Guiana.]

1916. *Paroecanthus picipes* Bruner, Ann. Carnegie Mus., X, p. 422. [♂; Quatro Ojos, Bolivia.]

Study of a series of seventeen specimens and the original descriptions convinces us of the synonymy indicated above.

Saussure's figures of the cephalic tibial auditory foramina are taken from dorsal and ventro-internal aspects, those of Chopard of the external and internal faces, this explaining the apparent differences in these organs. We believe further that Saussure had a specimen of another species in his original series with annulate antennae, that probably being the measured female which shows considerably greater size than any of the material before us. The antennae are never annulate in the species here recognized as *podagrosus*.

The descriptions of *vicinus* and *picipes* give no other differences which might have specific value, the latter insect being larger than usual, a feature we have noted in other species reaching Bolivia from the Amazonian regions. The caudal femora vary individually from solid blackish brown, through light brown becoming gradually blackish distad to solidly light brown, the cephalic and median limbs being usually blackish brown but similarly individually variable. Never are the femora sharply and conspicuously bicolored as in the related *P. roosevelti* Rehn and *P. hesperus* Hebard.

France Field, Canal Zone, July 7, 1920, (M. Hebard; in swamp area), 1 juv. ♀.

Barro Colorado Island, Gatun Lake, C. Z., March 31 to April 4, 1924, (J. C. Bradley), 1 ♂, 5 ♀, (limbs solidly dark in four, pale proximad becoming dark distad in two).

Pedro Miguel, C. Z., 2 ♀, (limbs solidly pale).

Material of this species is also before us from Nicaragua, Costa Rica, Colombia, Trinidad and Peru.

Amblyrhethus ponderosus new species (Pl. XXV, fig. 6.)

This insect is very closely related to the Colombian *A. brevipes* (Saussure). It is distinguished by the cephalic tibiae having auditory foramina on both faces, the even broader form and more solidly dark base of fastigium, occiput and disk of pronotum.

Type: ♀; Porto Bello, Panama. February 15, 1911. (E. A. Schwarz.) [U. S. N. M.]

Size medium, form extremely robust. Head, pronotum and limbs thickly covered with short pile. Head large, flattened dorsad; vertex appearing dorsad very broad, but narrowing ventrad and there rounding evenly into the face and less than twice the width of a proximal antennal joint. Ocelli very small, placed on a convex line, the median ocellus represented only by a spot. Palpi short, ultimate joint very slightly expanding, over twice as long as broad, truncation reaching two-thirds distance to base. Pronotum wider than long, very faintly broadening caudad, caudal margin almost straight but showing a feeble angulate convexity. Tegmina glabrous, slightly surpassing apex of abdomen; dorsal fields weakly convex with nine oblique sectors connected by a fine network of veinlets which form intervals of regular size but uneven form; lateral fields oblique, embracing abdomen, mediastine vein with (ten to eleven) oblique branches. Wings scarcely surpassing tegmina. Limbs short and heavy. Cephalic tibiae with large oval auditory foramina on caudal faces and much smaller, less elongate foramina on cephalic faces. Caudal tibiae with few stout teeth between the five external and four internal spines; the three pairs of spurs short, the dorso-internal the longest. Caudal metatarsus short, armed dorsad with two stout internal teeth in addition to the distal pair. Ovipositor short, lanceolate apex broader than deep, tapering to a blunt tip, dorsal valves there roughened with external margin coarsely and internal margin very finely serrulate, the teeth quadrate, ventral valves more strongly tapering, then with two rounded projections and apices broader [38].

Head snuff brown, occiput and base of fastigium bister, this terminating in the convex line which runs through the ocelli, the occiput very slightly paler and more chestnut mesad. Antennae buffy with very short, irregular, frequent annuli of brown or dark brown. Pronotum and tegmina snuff brown, the former

[38] A structure generally similar to that of *brevipes*, figured by Saussure, Mém. Soc. Genève, XXV, pl. 18, LXV, fig. 1b, (1878).

with disk bister and, like the occiput, very slightly paler and more chestnut mesad. Limbs snuff brown; the caudal femora paler, sayal brown; the caudal tibiae darkened dorsad.

Length of body 17, length of pronotum 3.9, caudal width of pronotal disk 5.3, length of tegmen 14.7, exposed length of wing .5, length of caudal femur 10.8, greatest width of caudal femur 4.6, length of ovipositor 6.2 mm.

Orocharis latifrons Rehn

1909. *Orocharis latifrons* Rehn, Ent. News, xx, p. 211, text fig. [♀; Benque Viejo, British Honduras.]

Gatun, Canal Zone, July 17 to 23, 1916, (D. E. Harrower), 1 ♀.
Gulf of San Blas, Colon, July, 1922, (D. E. Harrower), 1 ♂, [A. N. S. P.].

The tegmina of this male agree closely with those of *O. cayennensis* Saussure as originally figured [39]. Compared with a Costa Rican male recorded as that species by Rehn [40], these organs are seen to differ in *latifrons* only in being slightly broader, the cephalic angle of the speculum being rectangulate instead of subrectangulate. The palpi are, in eight specimens before us referred to these two species, exactly as originally figured for *O. tibialis* Saussure [41].

Three females of *latifrons* before us show the following measurements (in millimeters).

	Length of caudal femur	Length of ovipositor
Benque Viejo, British Honduras. *Type.*	13.6	17.8
Ujarras de Terraba, Costa Rica.	13.8	17.1
Gatun, Canal Zone, Panama.	14.2	17.3

There is also a male from Paramaribo, Surinam, in the author's collection which agrees fully with the male here recorded and we have recently recorded a similar male from southwestern Colombia. The distribution suggests that the insect may indeed represent *cayennensis* with *latifrons* a synonym, the Costa Rican species which has been recorded as *cayennensis* representing a very closely related species with speculum of male tegmen subrectangulate and ovipositor of female shorter. We feel that more definite evidence of the correct association of the

[39] Biol. Cent.-Amer., Orth., I, pl. 13, fig. 23.
[40] Proc. Acad. Nat. Sci. Phila., 1905, p. 836.
[41] Biol. Cent.-Amer., Orth., I, pl. 13, fig. 25.

sexes and additional South American material is needed before such can be assumed, involving the making of a synonym and description of a new species.

Euscyrtus mexicanus Saussure

1874. *Euscirtus mexicanus* Saussure, Miss. Sci. Mexique, Rech. Zool., Orth., p. 501, pl. 7, fig. 14. [♀, eastern Cordillera of Mexico.]

Ancon, Canal Zone, August 6, 1924, (N. Banks), 1 ♀, (macropterous).

Old Panama, November 13, 1913, (M. Hebard; beaten from bushes), 1 large juv. ♀.

The macropterous adult of this slender species is gray streaked with brown, the wings showing dark flecks in the principal veins dorsad as originally described.

The species is now known from Mexico to Panama. It is the only described American species of a genus widespread in the Orient.

Podoscirtus orocharoides new species (Pl. XXVI, figs. 3 and 4.)

This insect might easily be confused with *Orocharis latifrons* Rehn, the male sex differing in having the tegmina unspecialized, virtually identical with those of the female of that species. Examination shows the following additional differences; form more slender, head proportionately slightly smaller with eyes slightly more prominent, ocelli much larger and more closely placed, fastigium narrower and palpi with ultimate joint shorter and more strongly infundibuliform. Agreement in general contour, color, auditory foramina, limbs and their armament indicates much closer affinity than would be supposed to exist on considering the entirely different development of the male tegmina.

Comparison with a specimen in the author's collection of the huge and brilliantly colored Malagasian genotype *P. crocinus* Serville suggests that the present insect is probably generically separable, but no safe basis for such action is available until revision with many species for comparison can be made, as it is evident that species representing distinct phyla have been included in *Podoscirtus,* all agreeing in the probably insufficient characters which in combination have been considered diagnostic for the genus.

The size and almost immaculate light brown coloration distinguish this insect from any other American species referred to *Podoscirtus*.

Type: ♂; Barro Colorado Island, Gatun Lake, Canal Zone, Panama. April 2, 1924. (J. C. Bradley.) [Hebard Collection, Type No. 1112.]

Size medium and form slender when compared with the normal for *Orocharis* Uhler. Lateral ocelli very large, the median inserted closely between them cephalad and slightly smaller, with a small, smoothly deplanate area on the fastigium beyond it. Apex of fastigium about two-thirds width of proximal antennal joint. Palpi elongate, ultimate joint expanding gently and then very strongly dorso-distad, so that the dorsal margin is concave; distal truncation transverse, straight, two-thirds the length of the ventral margin. Pronotum expanding very feebly caudad, there about as broad as long, caudal margin showing very weak and broad median convexity; lateral lobes longer than deep, their contour exactly as in *Orocharis latifrons*. Tegmina elongate, simple, as in the female sex of that species but slightly narrower, microscopically pilose laterad and distad. Wings similarly considerably surpassing tegmina. Subgenital plate elongate conical. Limbs as in *Orocharis latifrons*, the caudal femora slender. Cephalic tibiae considerably broadened about the large oval auditory foramina but not swollen, those of the cephalic faces the larger. Caudal tibiae dorsad with numerous marginal teeth to near base and eight internal, five (or six) external, rather short spines, the dorso-internal spur much the longest of the three pair, three-quarters as long as the rather short metatarsus which is armed dorsad with two (or three) external and one disto-internal minute teeth.

General coloration uniform tawny olive. Antenna immaculate. Tegmina with a minute fleck of blackish brown including the adjacent discoidal and median veins above the base of the caudal femur, the median vein caudad with nine or ten very minute, well spaced, short streaks of dark brown.

The measurements of a paratypic male taken at Cachi, Costa Rica, October 1, 1910, by C. H. Lankester and belonging to the Academy, follow those of the type. Length of body 15.3 and 18 [42], length of pronotum 2.7 and 2.7, total caudal width of pronotum 3.6 and 3.6, length of tegmen 16.7 and 18.3, greatest dorsal width of tegmen 4.6, length of caudal femur 11.8 and 11.7, greatest width of caudal femur 2.8 and 2.8 mm.

[42] Abdomen extruded.

APHONOMORPHUS Rehn

There are now eighteen described American species which we recognize as belonging to this genus, the genotype of which is the Guianan *A. mutus* (Saussure), a small uniformly colored insect closely agreeing with *Orocharis* Uhler except in the very striking difference of lack of specialization in the male tegmina.

From this type we find various transitional steps to larger forms with elongate male subgenital plate, which include a large portion of the species. The small size and attenuate form of still other species suggests *Stenoecanthus* Chopard and others are small and robust suggesting *Ectotrypa* Saussure or, to a lesser degree, *Hapithus* Uhler.

Only a few species are distinctively marked and differences in degree are found to separate many species rather than outstanding structural characters.

A majority of the earlier described species were inconspicuously colored and are difficult to locate from the original descriptions.

We have now before us at least thirty species, mostly belonging to the Philadelphia Collections, all referable to *Aphonomorphus* [43] and the large majority from tropical South America. In not a single case is a fairly large series represented. It was found necessary to study all of this material before the species discussed could be placed with any accuracy.

Aphonomorphus tenebrosus new species (Pl. XXVII, fig. 1.)

This dark and not distinctively colored species agrees closely with the strikingly marked *A. bicolor* here described in ocelli, palpi, comparatively robust limbs and annulate antennae. The female is not quite as large as males of that species, so that males of *tenebrosus* are probably considerably smaller. The limb armament is very similar except that the caudal tibiae have six instead of five dorso-internal spines.

Comparison with a Colombian female which we believe represents the poorly described *A. tumidus* (Saussure), we find that

[43] In addition to these, material of Saussure's *peruvianus* and a related South American species appear to represent a distinct though closely allied genus.

species to differ in the larger size, more elongate form, longer organs of flight, longer and decidedly less robust caudal femora, paler and less reddish general coloration and internal spur of caudal metatarsus which slightly surpasses the apex of the last joint. In ocelli, annulate antennae and other features of limb armament these species agree closely.

Type: ♀; Gatun, Canal Zone, Panama. August 6 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type No. 1114.]

Size slightly under medium, form robust for the genus. Ocelli located on a convex line, the median very small and transverse with a very small smooth area before it, separated from the large round lateral ocelli by a distance equalling the width of one of the latter. Fastigio-facial projection at apex wider by one-third than proximal antennal joint. Palpi elongate; ultimate joint short, expanding decidedly dorso-distad so that the dorsal margin is decidedly concave, the distal margin very weakly convex and very slightly shorter than the straight ventral margin, with which it forms a rightangle. Pronotum with caudal margin very weakly obtuse-angulate produced mesad and very weakly concave on each side. Tegmina very slightly surpassing apices of the very robust and short caudal femora, wings projecting a short distance beyond. Ovipositor slightly ascending and weakly decurved, the slenderly lanceolate apex armed ventrad with a row of large rounded teeth, bordered externally with a row of similar but decidedly smaller teeth and with adjacent convex surface granulose. Subgenital plate with lateral margins convex-convergent, rounding into the distal concave margin. Limbs decidedly hirsute. Cephalic tibiae with cephalic and caudal faces flattened, the former with a deeply set, large oval auditory foramen, the latter showing only a trace of convexity opposite. Caudal tibiae armed on dorsal margins with very numerous short teeth, six internal and five external spines and distad with three pairs of spurs of which the dorso-internal is slightly over two-thirds as long as the metatarsus. Caudal metatarsus armed dorsad with three internal and one disto-external teeth, the longest (internal) spur not reaching the apex of the last joint.

Pronotum, occiput and fastigium solidly black with a weak chestnut tinge, the eyes and head elsewhere paling to russet and hazel. Palpi hazel, the last joint tipped dorsad with blackish brown. Antennae dresden brown becoming dark brown before widely spaced, minute annuli of buff. Tegmina chestnut brown, translucent when spread and then only showing mere traces of six oblique darker bands, the lateral margins of the dorsal field from near base to near apex buffy with numerous elongate flecks

of blackish brown; intercalated area hyaline, very weakly embrowned as are the wings except for the usual apical patch of the tegminal color. Abdomen shining chestnut brown. Limbs with femora to near apices hazel, elsewhere blackish brown, except the caudal tibial spines and longer spurs, which are buffy tinged with brown mesad. Caudal metatarsus buffy tinged with brown dorsad, its spurs and the ultimate tarsal joint buffy.

Length of body 18.2, length of pronotum 3.8, caudal width of pronotal disk 4, length of tegmen 17.8, exposed length of wing 2.1, length of caudal femur 13.8, greatest width of caudal femur 4, length of ovipositor 13.3 mm.

An immature female is also before us, bearing the same data except that it was taken the preceding week.

Aphonomorphus flavifrons (Saussure)

1897. *Aphonus flavifrons* Saussure, Biol. Cent.-Amer., Orth., I, p. 281, pl. 13, figs. 31 and 32. [♂; Teapa, Tabasco, Mexico.]

France Field, Canal Zone, August 18, 1920, (M. Hebard; beaten from vines growing over palm fronds under which were dead leaves and litter, in swamp area, 1 ♀.

The broad interocular bar of buff, which includes the ocelli and proximal antennal joints and narrow medio-longitudinal blackish streak on the external face of the caudal femora, are distinctive features for this handsome species.

The ultimate palpal joint is longer than in *A. tenebrosus* here described, but more strongly securiform, so that the dorsal margin is even more strongly concave, the distal margin moderately convex and very slightly longer than the straight ventral margin. The caudal tibiae are armed with five pairs of spines.

Length of body 19.7, length of pronotum 3.4, caudal width of pronotal disk 4.8, length of tegmen 21.8, width of tegminal dorsal fields 6.8, exposed length of wing 5.8, length of caudal femur 14.8, greatest width of caudal femur 4.6, length of ovipositor 16.8 mm.

Aphonomorphus bicolor new species (Plate XXIV, fig. 7.)

This is the handsomest known species of the genus, distinguished by the buffy caudal femora strikingly marked with a broad longitudinal band of black slightly below the median line, which spreads to include the entire distal extremity.

It is related to *A. tenebrosus* here described, from which species

it is further separable by the larger size, slightly more robust form, larger median ocellus with larger impressed area, more strongly securiform ultimate palpal joint and five pairs of caudal tibial spines.

Between these species stands *A. flavifrons* (Saussure), intermediate in palpal development, with cephalic markings more striking and caudal femoral markings distinctive but much less conspicuous than in *bicolor*. The ocelli of *bicolor* and *tenebrosus* are more similar, not as closely placed and on a more arcuate line than in *flavifrons*, but the number of caudal tibial spines is the same in *bicolor* and *flavifrons*, while the former shows weakly the cephalic marking so strikingly developed in the latter.

Type: ♂; Gatun, Canal Zone, Panama. July 17 to 23, 1916. (D. E. Harrower.) [Hebard Collection, Type No. 1113.]

Size slightly above medium, form decidedly robust for the genus. Ocelli located on a convex line, the median small and weakly transverse with a large smooth impressed area before it, separated from the larger round lateral ocelli by a distance equalling the width of one of the latter. Fastigio-facial projection very slightly narrower at apex than in *tenebrosus*. Palpi elongate, the ultimate joint not as elongate as in *flavifrons* but as strongly securiform, so that the dorsal margin is as strongly concave, the distal margin moderately convex and distinctly longer than the straight ventral margin. Pronotum with caudal margin very weakly obtuse-angulate produced mesad and weakly concave on each side. Mesonotum and metanotum not strikingly specialized. Tegmina briefly surpassing apices of the very robust and short caudal femora, surpassed by the wings by a somewhat longer interval than in *tenebrosus*. Subgenital plate elongate scoop-shaped, with broad and subchitinous apex bilobate; a broad medio-longitudinal canaliculation very feebly indicated proximad, becoming gradually more prominent, deep and hirsute distad. Concealed genitalia extremely complex. Limbs, cephalic tibial contour, caudal tibiae and metatarsi as described for *tenebrosus* except that there are five pairs of caudal tibial spines and the dorso-internal spur is slightly longer.

Pronotum, occiput to ocelli, cephalic and median femora and tarsi, and all tibiae blackish brown, the pronotal disk with a pair of feebly indicated areas which are more russet. Ocelli and interocular area ochraceous tawny and paling dorsad, becoming deep russet below the russet eyes. In the Costa Rican paratype chestnut brown below, thus making an interocular pale bar almost as marked as in *flavifrons*. Palpi of the same color as the face, the ultimate joint blackish brown distad. Antennae pale ochraceous tawny with very weakly indicated buffy annuli otherwise simi-

lar to those of *tenebrosus*. Tegmina buckthorn brown, the lateral fields somewhat darkened, the lateral margins of the dorsal field almost or wholly immaculate; intercalated area and wings as in *tenebrosus*. Caudal femora light ochraceous buff with a broad sub-median longitudinal band of blackish brown which spreads to include the whole distal half of the limb. Caudal tibial spines and spurs, cephalic and median tarsi, caudal metatarsal spurs and terminal joint buffy.

The measurements of the type are followed by those of a Costa Rican and then a Nicaraguan male paratype. Length of body 20, 19.5 and 19.3, length of pronotum 3.7, 3.7 and 3.3; caudal width of pronotal disk 4.8, 4.8 and 4.6; length of tegmen 20.8, 19.6 and 20; exposed length of wing 3.7, 3.7 and 3.7; length of caudal femur 15.4, 14.3 and 14.7; greatest width of caudal femur 4.8, 4.2 and 4.3 mm.

Specimens Examined: 3; 3 males.

Great Falls, Pis Pis River, Segovia, Nicaragua, May 24, 1922, (W. Huber), 1 ♂, *paratype*, [A. N. S. P.].

Santa Ana, Costa Rica, November, 1902, (C. F. Underwood), 1 ♂ [44], *paratype*, [A. N. S. P.].

Gatun, Canal Zone, Panama, July 17 to 23, 1916, (D. E. Harrower), 1 ♂, *type*.

Aphonomorphus obliquus Bruner

1916. *Aphonomorphus obliquus* Bruner, Ann. Carnegie Mus., x, p. 426. [♂; Santa Cruz de la Sierra, Bolivia.]

Barro Colorado Island, Gatun Lake, Canal Zone, July 13 and 18, 1924, (N. Banks), 2 ♂.

Material of this smaller species, of pinkish brown, vinaceous russet or pecan brown general coloration with strongly narrowing tegmina marked with a series of broad oblique suffused bands of darker (vandyke brown), is before us from British Guiana and Peru. The last joint of the palpi has the distal margin moderately convex and weakly oblique, distinctly shorter than the ventral margin. The cephalic tibiae are moderately inflated above and back of the auditory foramen. The caudal margin of the pronotum is decidedly rounded-trigonal produced mesad. The caudal tibiae are armed with five or six external and seven or eight internal spines and the internal spur of the metatarsus

[44] This specimen has been recorded as *A. silens* by Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 838.

falls short of the apex of the last joint. The male metanotum has a very large, quadrate, deeply impressed area clothed with numerous hairs. A distinct phylum from that of the genotype is evidently represented and generic separation will very probably be found to be necessary when the group to which *Aphonomorphus* belongs is better understood.

The present males [45] measure; length including tegmina 20.2 and 20.7, length including wings 23.2 and 24.6, length of pronotum 2.9 and 3, length of caudal femur 10 and 11.3, width of caudal femur 2.4 and 2.6 mm.

The species is evidently closely related to *A. griseus* Chopard[46], described from French Guiana. That insect apparently differs in the smaller size, less pinkish general coloration with narrower, less suffused and less strongly oblique dark tegminal markings. They apparently form one of the links between the large species of the genus and those which are smaller and in some cases almost as slender as *Stenoecanthus gracillimus* Chopard.

Aphonomorphus pusillus new species. (Pl. XXVI, fig. 5.)

This is the smallest known species of the very stout forms of the genus, apparently nearest *A. hapitheformis* Bruner, that species from the description apparently differing in the decidedly less uniform coloration, the occiput showing no depression, the shorter wings, much shorter caudal femora and scarcely canaliculate male subgenital plate.

In general appearance this insect does not resemble the normal forms of *Aphonomorphus* and is, though purely superficially, rather Ectotrypoid or Heterecoid than Hapithoid.

Type: ♂; France Field, Canal Zone, Panama. July 7, 1920. (M. Hebard.) [Hebard Collection, Type No. 1115.]

Size very small, form robust for the genus, organs of flight and limbs short. Occiput almost deplanate. Very small and narrowly transverse median ocellus located on a line between the cephalic margins of the large circular lateral ocelli and separated from them by a distance nearly equalling the diameter of one of them. Fastigio-facial projection very slightly broader

[45] The Bolivian type is larger. This we find to be frequently the case in species which, widely distributed through the Amazonian regions, reach southward into Bolivia.

[46] A Brazilian female is before us, recorded as *griseus* by Rehn, Proc. Acad. Nat. Sci. Phila., 1918, p. 230.

than first antennal joint. Palpi moderately elongate, last joint infundibuliform, the dorsal margin strongly concave, the distal margin transverse, nearly straight and decidedly longer than the ventral margin which is straight, becoming convex distad. Caudal margin of pronotum weakly convex mesad and weakly concave laterad. Tegmina failing to reach apices of caudal femora by a very brief distance and wings very slightly surpassing them. Subgenital plate elongate scoop-shaped, narrowing very weakly to the bilobate apex; its surface cleft to near base, this broadening so that over half the plate is occupied by a very broad canaliculation. Cephalic tibiae with cephalic and caudal surfaces flattened, the former with a small oval auditory formen beyond which the surface is concave for some distance. Caudal tibiae with numerous minute teeth, five external and five (or six) internal spines and three pairs of spurs, the longest (dorso-internal) about three-quarters the length of the short metatarsus, which is armed dorsad with three external and one disto-internal teeth. Internal spur of caudal metatarsus well surpassed by ultimate joint.

Occiput and pronotum uniform russet, other portions of head and antennae buckthorn brown, the latter with widely spaced very short annuli of slighly paler coloration preceded by weakly suffused areas. Tegmina cinnamon brown, the discoidal vein very slightly paler with elongate flecks of dark brown. Abdomen blackish brown. Limbs uniform ochraceous tawny, the caudal tibial spines and spurs slightly paler and slightly suffused mesad.

A paratype from Gatun is very intensive, much darker with occiput and pronotum blackish and tegmina prouts brown. In this specimen the discoidal vein is buffy with blackish flecks in much stronger contrast, while the caudal tibiae are blackish with spines and spurs buffy and very dark mesad.

The measurements of the type are followed by those of a male paratype from France Field and another from nearby Gatun. Length of body 14.8, 13.8 and 14.2; length of pronotum 2.6, 2.7 and 2.8; length of tegmen 11.8, 12.1 and 11.8; greatest width of tegminal dorsal fields 3.9, 3.8 and 4; exposed length of wing 1.8, 1.8 and 2; length of caudal femur 10.5, 10 and 10.7; greatest width of caudal femur 3.1, 3.1 and 3.2 mm.

Specimens Examined: 3; 3 males.

France Field, Canal Zone, July 7, 1920, (M. Hebard; in swamp area of palms and vines), 2 ♂, *type* and *paratype*.

Gatun, C. Z., July 25 to 31, 1916, (D. E. Harrower), 1 ♂, *paratype*.

Stenaphonus macilentus Saussure

1878. *A[phonus]* (*Stenaphonus*) *macilentus* Saussure, Mém. Soc. Genève, xxv, p. 666, pl. 19, LXXI, figs. 3 and 3a. [♂, ♀; Panama.]

This genus was originally incorrectly placed as a subgenus of *Aphonus* Saussure=*Aphonomorphus* Rehn. The single species there included is actually so close to *Tafalisca* Walker that revisionary studies may show *Stenaphonus* to have no more than subgeneric rank under that genus or to be a synonym.

Gatun, Canal Zone, August 6 to 22, 1916, (D. E. Harrower), 1 ♂.

The organs of flight are subject to great variation in length, those of the present male being much shorter than in a Nicaraguan male before us. These measure; length of tegmen 18.3 and 24.7, exposed length of wing 1.3 and 2.9 mm.

We have additional material of the species from Nicaragua and Costa Rica.

Mogoplistinae

Cycloptilum antillarum (Redtenbacher)

1892. *E[ctatoderus] antillarum* Redtenbacher, Proc. Zool. Soc. London, 1892, p. 218, pl. 17, figs. 16a and 16b. [♂, ♀; windward side of St. Vincent [, British West Indies],]

Ancon, Canal Zone, (W. M. Wheeler; on *Cordia gerascanthus* Jacq., a tree of the Ehretia family), 1 ♀, [Hebard Cln.].

Taboga Island, June 29, 1924, (N. Banks), 2 ♂.

Tabogilla Island, February 16, 1912, (A. Busck), 1 ♂.

In these males the cephalic pronotal width is contained distinctly over twice in its length. The ovipositor of the present female is 5.6 mm. in length; this dimension ranges from 4 to 5.5 mm. in large series of the species from the United States. The small sharp emargination of the female subgenital plate readily distinguishes this sex from *C. hesperum* (Rehn and Hebard).

The species is known from the northern coast of Colombia, the West Indies, Bermuda and in the southeastern United States from Texas to North Carolina. It is not known from Central America north of Panama.

Cycloptilum medium new species (Pl. XXVII, figs. 2 and 3.)

In relationship this species is very close to the author's recently described Colombian *C. scotops* and *annulatum*. The

former is distinguished by the very dark face and decidedly longer fourth palpal joint, the latter by the male tegmina having two pale flecks in the dark marginal band of the dorsal fields and both sexes with much more decided antennal and limb annuli and decidedly longer fourth palpal joint.

These three species resemble the widely distributed *C. antillarum* Redtenbacher in size and form but differ widely in the male sex in having the pronotum much less produced caudad, the distal portion of the tegmina projecting sufficiently to have all but the proximal portion of the speculum exposed. The females are more generally similar but have a broadly and shallowly emarginate (instead of sharply acute angulate emarginate) subgenital plate. In this feature close agreement with *C. lepismoide* McNeill, from the Galapagos Islands, is found, a species with male tegmina concealed and readily distinguished in both sexes by the unusually short caudal metatarsus.

Type: ♂ ; Barro Colorado Island, Gatun Lake, Canal Zone, Panama. July 20, 1924. (N. Banks.) [Mus. Comp. Zool.]

Size and form much as in *antillarum*, medium for the genus. Fastigium roundly produced with only a trace of a medio-longitudinal sulcus and with a strong proximal transverse sulcus, the sides of the protuberance flattened so that it is not as prominent and bulbous as in *antillarum*. Labrum decidedly impressed dorso-laterad as in that species. Palpal joints very slightly shorter and heavier than in *antillarum;* fifth joint very slightly shorter than fourth and fourth very slightly shorter than third (fifth as long as third and longer than fourth in *antillarum*), fifth expanding evenly to the weakly oblique truncate apex, the diameter of which is half the longest (dorsal) margin of the joint. Eyes much as in *antillarum*. Pronotum narrowing weakly cephalad with caudal production much less than in *antillarum*, the caudal margin very broadly convex. Tegmina with broad caudal portion exposed as far as proximal apex of speculum (and so very slightly more exposed than in *annulatum*) ; the speculum with surface longitudinally plicate and with an angulate vein, the angulation of which is meso-cephalad and is rounded sub-rectangulate; lateral fields considerably more exposed than in *antillarum,* the discoidal vein alone present and curving distad to the humeral vein, the discoidal-humeral area wholly visible. Cerci elongate but shorter than in many species of the genus. Genitalia, without dissection, apparently as in *antillarum*. Cephalic

tibiae with cephalic face bearing an oval tympanum dorso-proximad, as in that species. Caudal tibiae and tarsi similar, the longest tibial spur (medio-internal) slightly less than half as long as the metatarsus, the longer (inner) metatarsal spur three-fifths as long as the terminal tarsal joint.

Allotype: ♀; same data as type but taken July 23, 1924. [Mus. Comp. Zool.]

Generally similar to male, except as follows. Pronotum simple, tubular, truncate caudad. Tegmina absent. Ovipositor similar to that of *antillarum* but shorter. Subgenital plate weakly bilobate distad, the meso-distal emargination being shallow, rounded and shallowly obtuse-angulate.

General ground coloration reddish brown, becoming blackish on abdomen. Surface, except of face, antennae, palpi and tegmina, heavily coated with metallic dark gray and silvery scales, the abdomen light and uniform in coloration, the other portions darker with a silvery line on lateral lobes of pronotum, an area of the same proximad and mesad on the dorsal surface of the caudal femora and the limbs elsewhere moderately annulate. Antennae yellowish buff with very small and very widely spaced annuli of dark brown. Face and palpi reddish brown, often slightly darker than elsewhere, but the former never strikingly darkened as in *scotops*. Male tegmina transparent tinged with light reddish buff, the ventral margins of the lateral fields white, this followed by a broad band of chestnut, another broad band of chestnut bounding solidly the distal margin of the dorsal fields.

The measurements of the type and allotype are given first for the sex. Length of body ♂ 8.6 to 9, ♀ 8.2 to 8.5; length of pronotum ♂ 3.6 to 3.8, ♀ 2.6 to 2.7; caudal width of pronotum ♂ 2.7 to 2.8, ♀ 2 to 2; length of caudal femur ♂ 5.7 to 5.9, ♀ 5.2 to 6; width of caudal femur ♂ 2.1 to 2.2, ♀ 1.9 to 2.2; exposed length of male tegmen 1.8 to 1.9; length of ovipositor 4.1 to 4.4 mm.

Specimens Examined: 10; 3 males, 5 females and 2 immature individuals.

France Field, Canal Zone, July 7 and August 8, 1920, (M. Hebard; from vine masses in swamp area), 2 ♀, *paratypes*, 1 juv. ♂.

Barro Colorado Island, Gatun Lake, Canal Zone, July 16 to 25, 1924, (N. Banks), 3 ♂, 2 ♀, *type*, *allotype* and *paratypes*, 1 juv. ♂.

Old Panama, November 13, 1913, (M. Hebard), 1 ♀, *paratype*.

Gryllotalpinae

Scapteriscus didactylus (Latreille)

1804. *Gryllotalpa didactyla* Latreille, Gen. Crustac. Ins., XII, p. 122. [Cayenne; Surinam.]

San Pablo, Canal Zone, March 29, 1911, (Schwarz and Jennings), 2 very small juv.

These individuals appear to represent this species, material of which we have showing a distribution which extends from Costa Rica to Bolivia and Paraguay.

We have discussed this and related species, finding differences from our previous concepts, in a recent paper on Colombian Gryllidae [47].

Gryllotalpa hexadactyla Perty

1832. *G[ryllotalpa] hexadactyla* Perty, Delect. Anim. Artic. Brasil., p. 119, pl. 23, fig. 9. [Mountains of Minas Geraes, Brazil.]

Tabernilla, Canal Zone, July, 1907, (A. Busck), 1 juv.
Pinogana, Darien, December, 1915, (Muñoz), 1 ♀.

This, the common American Mole-cricket, is known from Ontario, Canada, south to Peru and Brazil.

Tridactylinae

TRIDACTYLUS Olivier

1789. *Tridactylus* Olivier, Encycl. Méthod., Ins., IV, p. 26. Genotype.—*T. digitatus* (Coquebert).

1902. *Ellipes* Scudder, Psyche, IX, p. 309. Genotype.—*E. minuta* (Scudder).

We find that, when compared with the genotype of *Tridactylus* and other species before us (discussed below), *minutus* shows insufficient characters to warrant generic separation.

The presence or absence of a lamellate caudal metatarsus has specific and not generic significance as shown by its varied combination with other characters in different species. The caudal metatarsus is well developed in *inflatus, digitatus, savignyi, tartarus* and *apicialis;* it is virtually absent in *minutus, rostratus* (here described), *variegatus, japonicus* and *pulex.*

The presence or absence of lamellate spines (natatory lamellae) on the caudal tibiae is likewise generically valueless.

[47] Trans. Amer. Ent. Soc., LIV, pp. 119 to 122, (1928).

In *minutus* these are sometimes absent and when present individually vary from one and none to three and two. They are described as absent in Saussure's unique type of *denticulatus*. In all the other species before us they are prominent, always numbering four and three [48].

The pronotum shows a fine transverse sulcus cephalad only in *apicialis* and *inflatus* of the species before us. This feature is, therefore, not characteristic of the genotype of *Tridactylus* [49] and can not be used, as has been done by Scudder and Blatchley, to distinguish *Ellipes*.

In size *minutus, rostratus, savignyi* and *pulex* are small and *apicialis* and *thoracicus* large.

In all of the species here considered the caudal tibiae are armed with two pairs of lamellate distal spurs, of which the more proximal pair are much the shorter; these and the metatarsus, when present, may be easily distinguished from the lamellate spines by their uncinate apices.

The caudal tibiae have their dorsal margins moderately lamellate and smooth, very faintly or decidedly toothed before the lamellae.

Material of all the species mentioned here, except *denticulatus*, is in the Philadelphia collections. This material has been studied at the present time solely to determine the status of *Ellipes*. We agree with Chopard that revision of the Old World species is needed, which will probably reduce the number of names which should be recognized as having specific validity. Many synonyms of the commonest American species, *minutus* and *apicialis*, have already been established.

Tridactylus minutus Scudder (Pl. XXVI, fig. 6.)

1862. *T[ridactylus] minutus* Scudder, Boston Jour. Nat. Hist., VII, p. 425. [♂; southern Illinois.]

Tabernilla, Canal Zone, May 13, 1907, (A. Busck), 1 ♀.

Barro Colorado Island, Gatun Lake, C. Z., July 13, 1924, (N. Banks), 1 ♂, 1 ♀.

[48] Saussure overlooked the fact that there were four dorso-external but only three dorso-internal lamellate natatory spines in these species. His generic diagnosis is, however, excellent; Mém. Soc. Genève, XXV, p. 44, (1877).

[49] Two specimens from Dimbroko, Ivory Coast, Africa, determined as *digitatus* by Chopard, are in the author's collection.

San Pablo, C. Z., March 29, 1911, (A. H. Jennings), 1 ♂, 1 ♀.
Red Tank, April 14, 1923, (R. C. Shannon), 1 ♀.
Corozal, C. Z., November 17, 1913, (M. Hebard; on moist soil among scanty grasses), 2 ♂, 1 ♀.

In these specimens the natatory lamellate spines of the caudal tibiae number one to three external and one to two internal. These spines are individually variable in *minutus*, showing considerable reduction when compared with the normal developed in the genus. Their number apparently has some geographic significance, though it is sufficiently inconstant to prohibit the recognition of any races. Our material shows the following diversity of spine count. Large California and Sinaloa series have one and one, with a single exception which has one and none; large Georgia and Florida series none and none, with a single exception of none and one; northward on the Atlantic Coast of the United States much more variation is found, the individual range being from two and two to none and none, often two and one, which is much the same as shown by material from the central United States and Vera Cruz, Mexico.

The species is known from New Jersey, South Dakota and southern California south to the Argentine [50].

Tridactylus rostratus new species (Pl. XXVI, fig. 7.)

Named in allusion to the strongly rostrate subgenital plate of the female, which has a narrowly truncate apex, this insect is further distinguished from the otherwise closely similar *T. minutus* Scudder by its even smaller size, it being the smallest known species of the genus.

Type: ♀; Bocas del Toro, Panama. July, 1908. (Wirt Robinson.) [U. S. N. M.]

Size even smaller than *minutus* and form more slender. Interocular space narrower, distinctly less instead of more than

[50] We have Argentinian material before us, determined as *minutus*, but all are males. Without females we can not be certain that the present species occurs there. Chopard's descriptions of *Tridactylus wagneri* and *Ellipes muticus* from Argentina are unsatisfactory and the validity of those names is open to serious question; (described Bull. Mus. d'Hist. Nat. France, 1920, pp. 208 and 211). A female from Pará, Brazil, recorded by Rehn as *E. minuta* is before us, which species it unquestionably represents.

the length of an eye. Median ocellus placed slightly in advance of the lateral ocelli and situated in a distinct pit. Antennae simple, with eleven joints. Pronotum transverse, without sulci; cephalic margin with a trace of concavity, caudal margin feebly convex. Tegmina and wings much as in *minutus*, the latter very slightly surpassing the cerci. Sternite preceding subgenital plate with caudal margin transverse. Subgenital plate with length exceeding its basal width by one-third; lateral margins weakly convex convergent in proximal third, thence weakly concave convergent to the rather narrowly truncate apex, which reaches as far as the ninth sternite. Ninth sternite consequently visible only laterad, with margins there convex; it is probably medio-longitudinally cleft as in this sex of *minutus*. Cephalic tibiae spatulate, their obliquely truncate apices armed with four claws. Median tibiae lamellate, oval with a short distal neck, length distinctly over twice breadth. Caudal tibiae with dorsal margins moderately lamellate, not dentate, armed distad with three external and two internal[51] slender lamellae which are distinctly shorter than the proximal pair of lamellate spurs, the latter slightly less that half as long as the distal pair of very elongate and slender lamellate spurs.

Head blackish brown becoming dark brown caudad, marked with buffy as follows; genae, internal margin of eyes, four small flecks on face, four larger flecks on occiput and a medio-longitudinal Y there with arms pointing toward the lateral ocelli. Pronotum buffy with two pyriform areas outlined in dark brown caudad which diverge cephalad and dark brown suffusions laterad. In intensive examples these dark brown suffusions become very extensive. Tegmina buffy suffused proximo-laterad and distad with dark brown and often tinged with brown in remaining dorsal portions. Wings buffy with dorsal margin and apices suffused with dark brown. Limbs buffy, strikingly marked with dark brown much as in *minuta*.

Length of body 3.5, length of pronotum .84, greatest total pronotal width 1.1, length of tegmen .63, exposed length of wing .92, length of caudal femur 2.4, length of caudal tibia 1.8, length of caudal tibial distal spur .98 mm. (by micrometer).

There are also before us six female paratypes and three immature females which bear the same data.

Tridactylus apicialis Say

1825. *T[ridactylus] apicialis* Say, Jour. Acad. Nat. Sci. Phila., iv, p. 310. [St. Johns River, Florida; Missouri as far as Council Bluff [, Iowa].]

San Pablo, Canal Zone, March 29, 1911, (A. H. Jennings), 2 ♂.

[51] This number is constant in the small series of *rostratus* before us.

Tabernilla, C. Z., May 11 to June 1, 1907, (A. Busck), 8 ♂, 6 ♀.

These individuals are distinctly smaller and more slender than material from the United States, decidedly smaller but no more slender than Mexican specimens before us. In general coloration they are dark. All have simple cephalic tibiae except one male, in which these members are angularly incised. This is a feature of mere individual variation, but once led to Saussure's synonym *fissipes*.

In this species the caudal tibiae bear four external and three internal, elongate, overlapping, lamellate spines distad.

The distribution of *apicialis* is known to extend from Ontario southward to the Argentine.

Ripipteryx pulicaria Saussure

1896. *Rhipipteryx pulicaria* Saussure, Biol. Cent.-Amer., Orth., I, p. 215, pl. 11, fig. 24. [♂, ♀; Dos Caminos in Guerrero, Atoyac in Vera Cruz, Teapa in Tabasco, Mexico.]

France Field, Canal Zone, August 18, 1920, (M. Hebard; in swamp area), 6 ♂, 9 ♀.

Barro Colorado Island, Gatun Lake, C. Z., July 13, 1924, (N. Banks), 1 ♂, 2 ♀, 2 juv. ♀.

Red Tank, C. Z., April 14, 1923, (R. C. Shannon), 1 ♀.

San Pablo, C. Z., March 29, 1911, (A. H. Jennings), 1 juv. ♀.

Zone limit five miles west of Empire, November 14, 1913, (M. Hebard; near heavy forest on damp ground), 1 ♂, 1 ♀, 3 juv. ♀.

Corozal, C. Z., November 17, 1913, (M. Hebard; on moist soil among scanty grass and a few in low vegetation of forest), 5 ♂, 8 ♀, 1 juv. ♂, 2 juv. ♀.

Old Panama, November 13, 1913, (M. Hebard; beaten from grasses in low open spot), 1 ♀.

This series averages dark in general coloration, with minute buffy vermiculations and flecks on occiput and pronotum greatly reduced. The antennae have one or two terminal joints dark brown, preceded by several buffy joints, the proximal joints dark more or less extensively buffy dorsad and a narrow buffy line from their bases margins the eyes and is briefly continued on the pronotum. The general coloration is blackish brown, the limbs flecked with buffy. The tegmina are blackish with a fleck or suffusion of buffy meso-dorsad, the closed wings blackish brown dorsad, elsewhere brownish buff.

Paratypic males from Teapa, Tabasco, Mexico, in the author's collection, like those of the present series, have simple antennae as in the female sex and a simple subgenital plate which is broadly convex distad. Additional material is before us from British Honduras, Nicaragua, Costa Rica and the northern coast of Colombia, showing several striking color phases [52].

Ripipteryx biloba new species (Pl. XXVII, fig. 4.)

This species belongs to the Pulicaria Group, which is distinguished by the very small size, very narrow interocular space and face and antennae unspecialized.

From *R. pulicaria* Saussure it is easily separated by the average larger size and more robust form, narrower interocular space, bilobate male subgenital plate and features of coloration.

Type: ♂; Upper Reservoir, Banana River, Costa Rica. Elevation 100 feet. November 9, 1909. (P. P. Calvert). [A. N. S. P., Type No. 5441.]

Size very small, form robust for the genus. Interocular space about one-sixth the width of an eye. Eyes very large. Ocelli moderately large and arranged in a triangle about twice as broad as deep. Area ventrad between the eyes and face slightly inflated, unspecialized. Antennae with ten unspecialized joints. Pronotum with caudal margin convex produced mesad, this more decided than in *pulicaria*, similarly with broad and weak concavity. Tegmina and wings fully developed. Supra-anal plate convex laterad and broadly medio-longitudinally concave, its distal margin angulato-bilobate. Cerci and appendages of ventral valves simple, the former cylindrical, the latter larger and somewhat spatulate. Subgenital plate with surface very feebly convex and showing faint impression disto laterad, margins convergent and very weakly convex to the bilobate apex. Limbs much as in *pulicaria*. Caudal tibiae with lamellate distal spurs well developed, the proximal pair distinctly over half as long

[52] Trinidadian material, recorded as *Tridactylus histrio* by Brunner in 1906, is found to represent a species extremely close to *pulicaria*, but apparently distinct, while material from British Guiana is generally very similar but represents still another species as shown by the decidedly higher specialization of the male subgenital plate, it being the species incorrectly recorded as *pulicaria* by Chopard from French Guiana. We are therefore unable to place with any assurance the female from Pará, Brazil, recorded as *pulicaria* by Rehn and it is probable that many if not all the other South American records of *pulicaria* are based on material of generally similar related species, distinguishable primarily by male genitalic features.

as the distal pair, the lamellate metatarsus slightly shorter than one of the proximal spurs.

Allotype: ♀; same data as type. [A. N. S. P.]

Agrees very closely with male, differing as follows. Size averaging very slightly larger, form slightly more robust. Mesocaudal production of pronotum weaker and broader. Penultimate tergite with a transverse trapezoidal emargination, the base of which is feebly convex produced, the briefly visible ultimate tergite cleft medio-longitudinally. Ovipositor valves short, the apices aciculate, curved.

General coloration of head, antennae, pronotum and dorsal surfaces of tegmina and wings buff strongly tinged with rufo-testaceous, the occiput particularly showing the rufous tinge. Face heavily marked with blackish brown, this forming a large median triangle between the eyes, occiput with flecks of the same and pronotal disk cephalad with similar flecks and two small circular markings, its lateral margins very narrowly and inconspicuously buffy. Lateral portions of tegmina black. Abdomen blackish brown, the tergites and sternites all margined with buffy. Cephalic limbs rufo-testaceous with longitudinal suffusions and bands of dark brown. Median limbs blackish brown with longitudinal lines of rufo-testaceous and a large dorsal fleck beyond the middle on both femora and tibiae. Caudal femora blackish brown with longitudinal lines of rufo-testaceous and ventral margin buffy, the tibiae brown with spurs and metatarsi buffy dorsad.

A single female is decidedly more intensive in coloration, the black markings fusing and spreading to cover a large part of the occiput and pronotum cephalad. The Panamanian male is also somewhat more intensively colored than the majority.

The large series taken with the type shows only very slight size variation. Length of body ♂ 3.78, ♀ 4.2; length of pronotum ♂ 1.17, ♀ 1.2; total width of pronotum ♂ 1.3, ♀ 1.45; length of tegmen ♂ 1.26, ♀ 1.3; length of exposed portion of wing ♂ 1.93, ♀ 2.18; length of longest (distal) caudal tibial spur ♂ .92, ♀ 1.05; length of caudal metatarsus ♂ .45, ♀ .48 mm. (by micrometer).

Specimens Examined: 62; 39 males, 14 females and 9 immature individuals.

Upper Reservoir, Banana River, Costa Rica, November 9, 1909, (P. P. Calvert; taken by sweeping) 38 ♂, 14 ♀, *type, allotype, paratypes,* 6 juv. ♂, 3 juv. ♀, [A. N. S. P.].

Zone limit five miles west of Empire, Canal Zone, Panama, November 14, 1912, (M. Hebard; near heavy forest on damp ground), 1 ♂.

Material of a closely related species from the upper Amazon is also before us.

Ripipteryx rivularia Saussure

1896. *Rhipipteryx rivularia* Saussure, Biol. Cent.-Amer., Orth., I, p. 212, pl. 11, fig. 20. [♂, Colombia.]

Porto Bello Trail, Canal Zone, (A. H. Jennings), 1 ♂.
Upper Rio Pequeni, March 20, 1909, (A. H. Jennings), 1 ♀.
Tabernilla, C. Z., May 9, 1907, (A. Busck), 5 ♂, 2 ♀.
Las Cascadas, C. Z., (A. H. Jennings), 1 ♀.
Empire, C. Z., May 8, 1909, (A. H. Jennings), 1 ♂.
Paraiso, C. Z., January 26, 1911, (E. A. Schwarz), 1 ♂.
Ancon, April 3 to 24, 1926, (C. T. Greene; in fern and on Papaya), 3 ♀.

Saussure was correct in supposing that the distribution of this species extended to Panama. It is not represented, however, in large collections now before us from north of the Canal Zone. It was reported from Trinidad by Bruner in 1906 and additional material from that island is now in our possession.

To the data given by Saussure on the intricate genitalia of the male of *rivularia* we add that the elongate proximo-lateral appendages of the elongate, linguliform supra-anal plate lie within the elongate, slender projections of the penultimate tergite and are comb-like, their ventral margins being armed with a fringe of erect, closely placed, chaetiform spines. The apex of the subgenital plate is formed by a small sharply angulate projection which is medio-longitudinally carinate and is flanked by small depressions, the distal margins of the plate being there weakly convex.

This and other yellow marked species of the genus, though so small that they are inconspicuous on the trails and on the forest foliage, are strikingly beautiful when more closely examined.

Plate XXIV

Fig. 1. *Hygronemobius darienicus* new species. Dorsal view of female. *Type.* Porto Bello, Panama. (X 8)

Fig. 2. *Ponca venosa* new species. Dorsal view of male. *Type.* Vesta Farm, Estrella Valley, Costa Rica. (X 3)

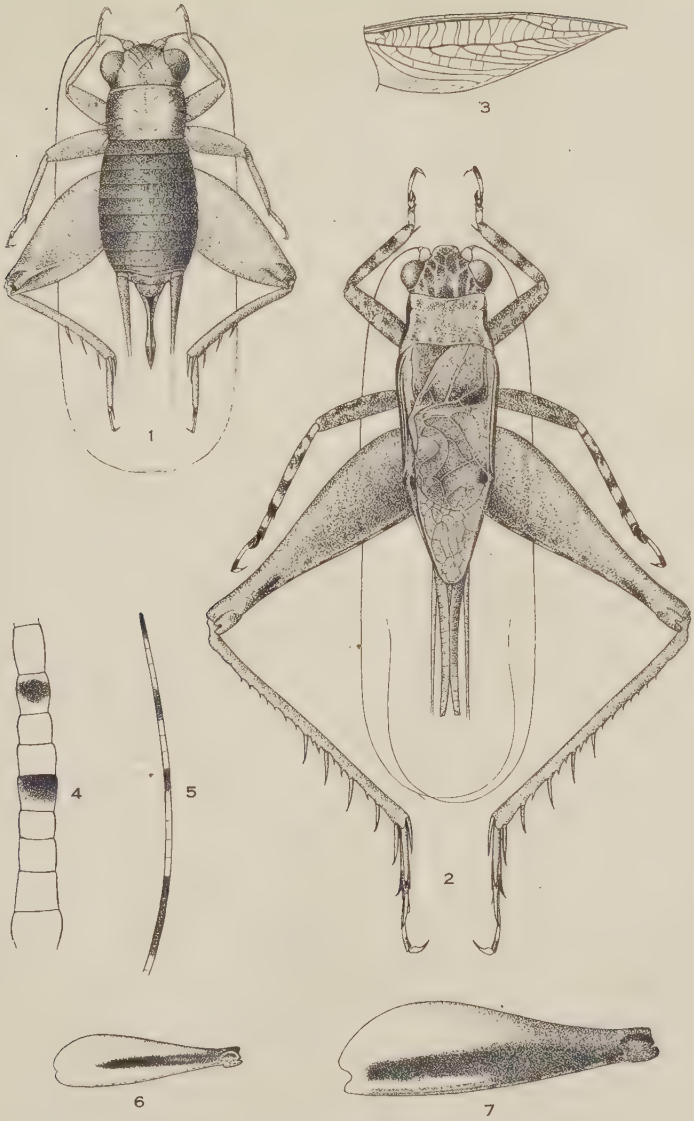
Fig. 3. *Ponca venosa* new species. Lateral outline of female tegmen, showing venation. *Allotype.* Vesta Farm, Estrella Valley, Costa Rica. (X 3)

Fig. 4. *Phyllogryllus hirsutus* new species. Proximal portion of female antenna. *Type.* Barro Colorado Island, Gatun Lake, Panama. (Greatly enlarged.)

Fig. 5. *Phyllogryllus hirsutus* new species. Distal portion of female antenna. *Type.* Barro Colorado Island, Gatun Lake, Panama. (Same scale as Fig. 4.)

Fig. 6. *Diatrypa univittata* new species. Lateral view of female caudal femur. *Type.* Barro Colorado Island, Gatun Lake, Panama. (X 4)

Fig. 7. *Aphonomorphus bicolor* new species. Lateral view of male caudal femur. *Type.* Gatun, Panama. (X 3)



HEBARD—GRYLLIDAE OF PANAMA

PLATE XXV

Fig. 1. *Quarequa annuliger* new species. Dorsal view of male. *Type.* Corozal, Panama. (X 5)

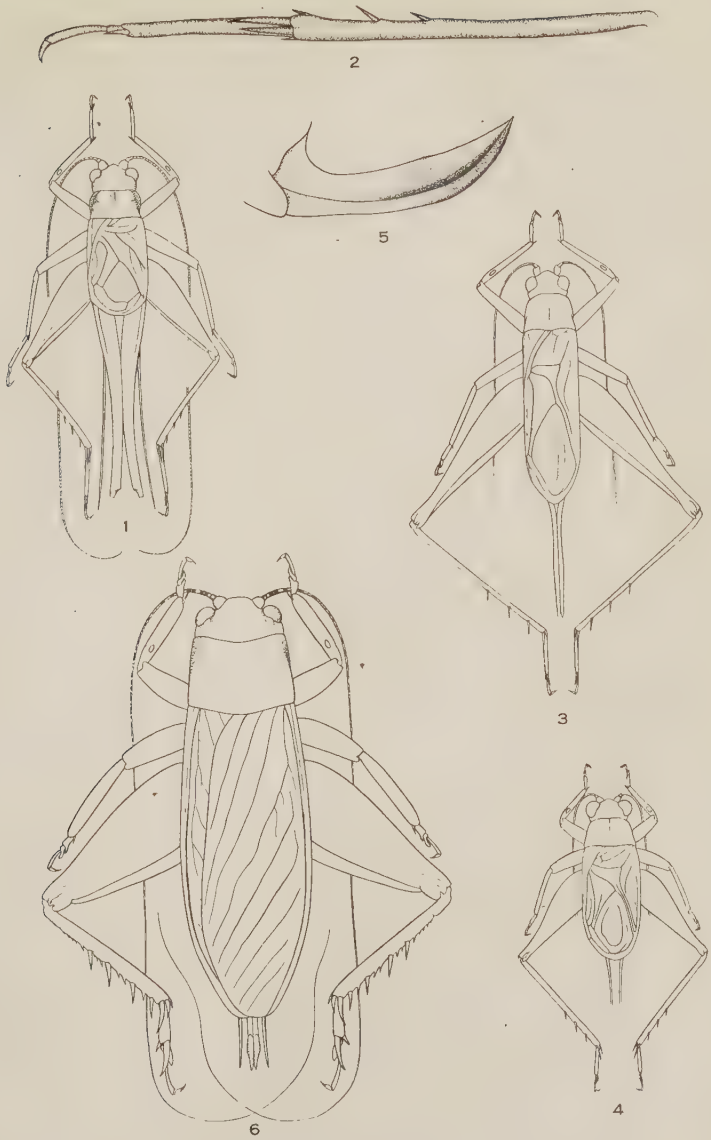
Fig. 2. *Quarequa annuliger* new species. Latero-internal view of male caudal tibia. *Type.* Corozal, Panama. (Greatly enlarged.)

Fig. 3. *Macroanaxipha macilenta* (Saussure). Dorsal view of male. Eden, Nicaragua. (X 5)

Fig. 4. *Symphyloxiphus nigrellus* new species. Dorsal view of male. *Type.* Aurora Farm, Estrella Valley, Costa Rica. (X 5)

Fig. 5. *Symphyloxiphus nigrellus* new species. Lateral view of ovipositor. *Allotype.* Guacimo, Costa Rica. (Greatly enlarged.)

Fig. 6. *Amblyrhethus ponderosus* new species. Dorsal view of female. *Type.* Porto Bello, Panama. (X 3)



HEBARD—GRYLLIDAE OF PANAMA

Plate XXVI

Fig. 1. *Hapithoides insolitum* new species. Dorsal outline of male. *Type.* Barro Colorado Island, Gatun Lake, Panama. (X 3)

Fig. 2. *Hapithoides insolitum* new species. Dorsal outline of female. *Allotype.* Barro Colorado Island, Gatun Lake, Panama. (X 3)

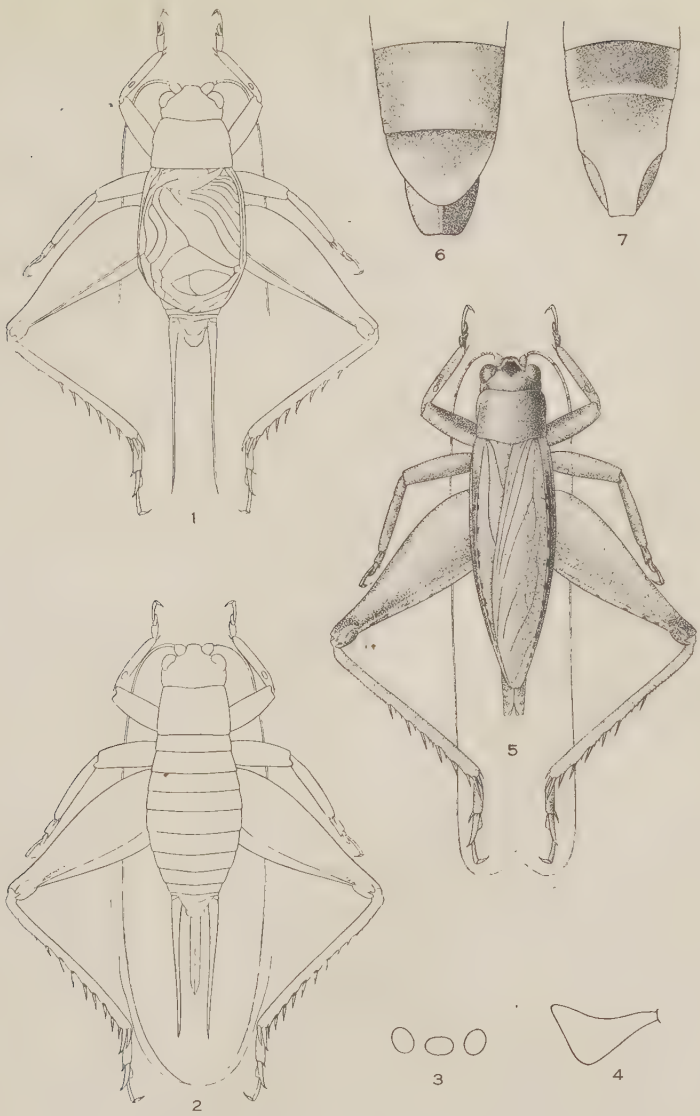
Fig. 3. *Podoscirtus orocharoides* new species. Dorsal outline of male ocelli. *Type.* Barro Colorado Island, Gatun Lake, Panama. (Greatly enlarged.)

Fig. 4. *Podoscirtus orocharoides* new species. Lateral outline of male distal palpal joint. *Type.* Barro Colorado Island, Gatun Lake, Panama. (Greatly enlarged.)

Fig. 5. *Aphonomorphus pusillus* new species. Dorsal view of male. *Type.* France Field, Panama. (X 3)

Fig. 6. *Tridactylus minutus* Scudder. Ventral view of distal portion of female abdomen. Corozal, Panama. (Greatly enlarged.)

Fig. 7. *Tridactylus rostratus* new species. Ventral view of distal portion of female abdomen. *Type.* Bocas del Toro, Panama. (Same scale as Fig. 6.)



HEBARD—GRYLLIDAE OF PANAMA

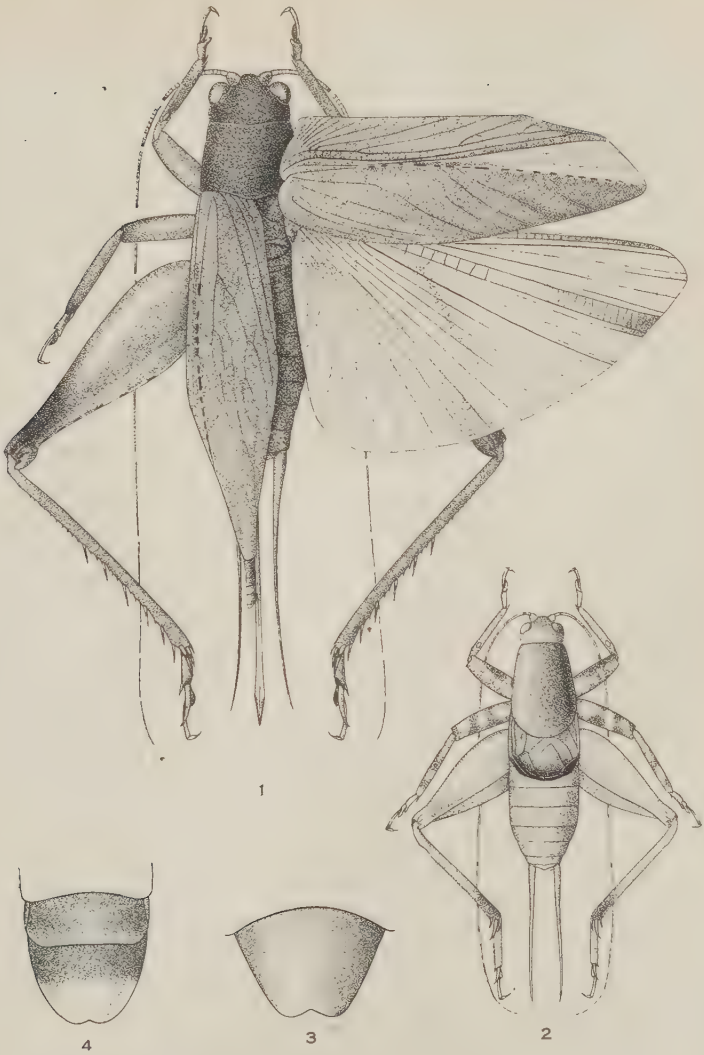
PLATE XXVII

Fig. 1. *Aphonomorphus tenebrosus* new species. Dorsal view of female. *Type.* Gatun, Panama. (X 3)

Fig. 2. *Cycloptilum medium* new species. Dorsal view of male. *Type.* Barro Colorado Island, Gatun Lake, Panama. (X 4)

Fig. 3. *Cycloptilum medium* new species. Ventral view of female subgenital plate. *Paratype.* France Field, Panama. (Greatly enlarged.)

Fig. 4. *Ripipteryx biloba* new species. Ventral view of distal portion of male abdomen. *Type.* Upper Reservoir, Banana River, Costa Rica. (Greatly enlarged.)



HEBARD—GRYLLIDAE OF PANAMA

A MORPHOLOGICAL AND SYSTEMATICAL STUDY OF UTAH ASILIDAE[1]

(DIPTERA)

By Claudeous J. D. Brown

CONTENTS

Introduction 295
Previous Workers 296
Acknowledgements 297
Family Characteristics 297
General Morphology of Genitalia 298
Descriptions of Species 301
Summary 318
Bibliography 319
Explanation of Abbreviations 320

Introduction

The Dipterous family Asilidae is among the most interesting yet the least known families of our section. A study of their peculiar predaceous habits, and their relatively wide variation and distribution, is not only an interesting task but a difficult one.

To date our western species, especially those from Utah, are almost unknown. This fact is too well exemplified by literature pertaining to Asilidae. Out of the many species that may be found in this region only five have been previously recorded. These represent five different genera; *Deromyia bigoti, Stenopogon californiae, Erax subpilosus, Cryptopogon plausor* and *Promachus aldrichii.*

There are, to date, nineteen known species in the Brigham Young University collection, representing eleven genera. These

[1] Contribution from the Zoological Laboratories of the Brigham Young University, Provo, Utah. No. 16. Presented as partial fulfillment for the degree of Master of Science, June, 1928.

specimens were not only taken from practically all counties of the state, but also from the border lines of Idaho, Wyoming, Colorado and Arizona. Their habitat ranges from the lower Sonoran to the Alpine Zones.

The taxonomist should aim to base his descriptions upon characters which remain constant. In view of this fact, the morphology of the insect body should be studied and all the permanent structures and their variability noted. The descriptions in this paper, therefore, not only include the more variable characters as color, size, etc., but also descriptions of male and female genitalia. The following study is not meant to be complete only in so far as our collection is complete. Future collections will no doubt reveal a greater number of species than are listed in this paper.

Previous Workers

In sifting the available literature, I have found very few references to Utah species and practically none on the general morphology of this family.

Linnaeus in the tenth edition of his Systema Natura, placed all the species of this family in the genus *Asilus*. Scopoli in 1763 erected the genus *Erax*, but Meigen in his Classification of 1803, ignored *Erax* and replaced the species in *Asilus*. Other workers added a few genera to these, but not until Loew began his studies, was the basic classification of Asilidae rendered useful to the average Dipterologist. All the Asilid publications including Loew's papers, which were completed up to 1866 were of a foreign nature, dealing mainly with material collected in Europe.

Say was the first to do work in America and is outstanding as a pioneer student of Entomology, but his descriptions in this family should not be classed with those of Loew and Osten Sacken, especially in the subfamilies Leptogastrinae and Dasypogoninae. Loew and Osten Sacken, according to Dr. Back (1909) classified 81.7 per cent of the species existing at that time (1878).

Of the early American workers, Dr. S. W. Williston takes the lead in giving us a systematic study of this family. Two

other notable workers were D. W. Coquillett and C. W. Johnson. About sixty new species and five new genera were added by these three men. Dr. Williston's greatest publication is, "On the North American Asilidae," published in 1884-85. The work of Dr. E. A. Back on the "Robber-Flies of America North of Mexico, belonging to the Subfamilies, Leptogastrinae and Dasypogoninae," is one of the most important contribution to our knowledge of this family. His earnest efforts in the classi fication of these two groups has been a constant aid to all contemporary students in this field. The literature since the publication of his paper (1909) is more or less fragmentary, with the exception of Dr. J. S. Hine's contributions. These cover the descriptions of four genera; *Promachus*, *Proctacanthus*, *Asilus* and *Erax*. They are lacking, however, in thorough morphological data. His attempt to use characters of the male genitalia as indices in classification, is only a meager beginning of what might be done. Despite this fact, his papers are extremely accurate in placing the species of those four genera.

Acknowledgements

In view of the fact of my dependence upon the assistance and suggestions of others, I wish to express my appreciation and gratitude to Dr. Vasco M. Tanner, under whose direction this paper was successfully completed. It was only through his help that I was able to homologize the Asilid genital structures.

I also wish to thank Mr. S. A. Rohwer and C. T. Greene of the National Museum, for the determinations made by them, of our Utah material, and for the courtesy in returning all specimens sent to them.

Finally I wish to extend my thanks to fellow students, whose kind associations and assistance have helped in the completion of this paper.

Family Characteristics

The family Asilidae consists as a whole of large, active Diptera. There are, however, some rather small species. These flies are, without exception, predaceous, often feeding upon their own kind.

The family is characterized by having an elongate body which is clothed in most genera with a rather dense growth of hair and bristles. The head is somewhat flattened, usually broader than high, and is separated from the thorax by a freely movable neck. The vertex is always distinctly depressed and the compound eyes are never contiguous. Three ocelli are present, located usually, upon a tubercle in the concavity of the vertex. The antennae are composed of three main segments, the third elongate, with or without a terminal style. Mouth parts are adapted for piercing.

The thorax of most species is much enlarged, being modified to support strong appendages, which are so necessary in predatory feeding. The legs are stout and comparatively long. The empodia are bristle like and the pulvilli are rarely if ever vestigial. Wings strong; when at rest they lie parallel over the abdomen. Basal cells long and prominent, two to three submarginal and usually five posterior cells.

The abdomen is ten segmented, elongate, the last two segments in the male and the last three in the female constitute the genitalia. These are, as a rule, very conspicuous.

General Morphology of the Asilid Genitalia

Since there has been but little detailed work done, on Asilid genitalia, with the exception of one plate and descriptions of the genera; *Dasyllis* and *Laphria* (Snodgrass 1902), it is necessary to make homologies from other groups that have been studied more in detail. For the nomenclature and homologies of this paper, I have followed, in the main, the system used by Dr. Vasco M. Tanner (1927), in the "Genitalia of female Coleoptera."[2] This nomenclature is used by Dr. G. C. Crampton of Massachusetts, also other insect morphologists.

The genital structures of Asilidae are found in the eighth, ninth and tenth abdominal segments. The oviduct of the female is found in connection with the eighth sternite, while the aedeagus of the male is a part of the ninth.

[2] Trans. Am. Ent. Soc., LIII, p. 5-50, 1927.

Male

Eighth Segment.—The eighth abdominal segment is membranous throughout in practically all of the species studied. Exceptions to this are; *Heteropogon ludius* (Pl. 29, figs. 24 and 25), in which the tergite is completely chitinized and the sternite partially so, and *Erax stamineus* (Pl. 29, figs. 40 and 41), the eighth of which is represented by two angular plates situated on each plura. *Dasyllis fernaldii* (Pl. 29, figs. 26 and 27) is peculiar, in that it is symmetrical as to form but not as to position, normally it is hidden under the seventh.

Ninth Segment.—The ninth tergite and sternite are variable as to form and somewhat as to position. In every case chitinization occurs. The ninth tergite is usually much lengthened and varied greatly as to width. At times its margins are strongly convex (Pl. 29, figs. 34 and 35) and in other species, it may be swollen posteriorly (Pl. 30, figs. 40 and 41). In the case of the inverted form, *Dasyllis fernaldii* (Pl. 29, figs. 26 and 27), it is entire and assumes a ventral position. In most cases the tergite consists of two distinct sclerites. The ninth sternite is represented by a broad plate, extending under and forming the base of the genital chamber (Pl. 29, figs. 12, 16, 20 and 24). In some cases, it is divided into two lobes (Pl. 29, figs. 31 and 32) and (Pl. 30, figs. 41, 45, 47, 49). In every case it bears one or two pair of appendages, the dorsal plates and the lateral plates, named because of the position which they normally occupy (Snodgrass, 1902). These articulate in the ventral notches of the ninth sternite. In some species it is difficult to distinguish between these appendages (Pl. 29, fig. 31 and Pl. 30, figs. 53 and 54). As a rule the lateral plates are much larger than the dorsal and remain if one pair should be missing. The dorsal, with a few exceptions, terminate in a spine or a very narrow lobe. The aedeagus is represented, in some species, by a simple tube, arising at the anterior margin of the ninth sternite (Pl. 29, figs. 12, 16, 20, etc.), while in others it is branched (Pl. 29, figs. 24, 27) (Pl. 30, figs. 47, 55), curved (Pl. 29, fig. 30) (Pl. 30, fig. 40) or enlarged. In every case it is very conspicuous and rests upon the floor of the genital chamber. It is supported in *Dasyllis fernaldii* (Pl. 29, figs. 26 and 27) by the paraproct of the tenth segment.

Tenth Segment.—In the simplest forms, the tenth segment of the male consists of two membranous lobes situated on the dorsal and ventral sides of the anal opening (Pl. 30, fig. 48). The more complex forms consist of two sets of plates; the proctiger and the paraproct. These assume various shapes and positions but are always found in close proximity with the anal opening. The tenth segment is in most cases, directed dorso-caudad above the ninth tergite.

Female

Eighth Segment.—The eighth segment is present as a distinct tergite and sternite. The tergite of this segment is always normal, being either sparsely or densely setiferous. The sternite is modified, in that it is extended far beyond the caudal margin of the tergite. In almost every species it is notched on the meson of its posterior margin. Thus dividing the caudal end into two lobes (Pl. 29, figs. 14, 19, 22, 32) (Pl. 30, figs. 37, 39, 43, 51, 56, 58). The vaginal opening (v) is without exception surrounded by membrane.

Ninth Segment.—Apparently the ninth segment is not divided into a tergite and a sternite. It is composed of the valvifers, coxites, and styli. All of these are not present at the same time, in any one species. Some have the coxite and style in combination (Pl. 29, figs. 15, 18, 23, 33), others have only the coxite to represent the ninth (Pl. 29, figs. 28, 29), the valvifer has shifted to a dorsal position and is present in connection with the coxite. The coxite of all the species, is usually represented by a dorso-anterior plate. The caudo-ventral margins of which, extend posteriorly under the tenth. In some species these margins fuse, forming a continuous sclerite (Pl. 29, fig. 32; Pl. 30, fig. 56). The styli are crescent shaped, having a concave anterior margin. They always bear one or two rows of strong spines (Pl. 28, figs. 7, 8, 9, and Pl. 29, figs. 15, 18, 23, 33).

Tenth Segment.—The tenth segment of the female is always dorsal as to position. In some species it is entirely membranous. While in others it consists of two dorso-lateral plates, the proctigers (Pl. 30, figs. 36, 38, 42, 50, 57, 59). The anal opening is always situated at the dorso-caudal margins of the proctiger.

Descriptions of Species.

Ospriocerus abdominalia (Say)

1824. *Asilus abdominalis* Say, Long's Exped., II, App., p. 375; Compl. Work, I, p. 255 [N. W. Terr.].

Length, male and female, 16-23 mm. Mystax sparse, composed of long rigid bristles which spread over the swollen basal part of face (of front); occiput silvery white. Antennae black and comparatively long; depression on inner distal part of segment three very distinct; bristles of vertex and occiput strong. Dorsum of thorax sub-polished, covered with fine black setiferous bloom; prothorax very bristly. Legs black, clothed with black hair and strong bristles. Wings fuscous, almost opaque, very broad and of medium length. Abdomen with first two segments black; second lighter at it's posterior margin; segments three to four orange red; last two segments of female polished black, reddish in the male.

Genitalia.—Male (Pl. 29, figs. 12 and 13). Eighth abdominal segment membranous; ninth sternite (9ths) narrow at lateral margins and terminating posteriorly in a single lobe, which bears several strong bristles. Ninth tergite (9tht) long, extending almost to the end of the tenth segment, broad at base and tapering to a blunt apex. Lateral plates (g) widest at the middle, extending to the aedeagus, bearing three strong bristles on each ventral margin, near the apex. Dorsal plates terminating in sharp spine, located directly above the lateral plates (a). Tenth segment composed of two lobes, the inner margins of which fold laterad. Proctiger (p) more chitinized than the anterior part of the tenth. Aedaegus (x) short and swollen posteriorly.

Female (Pl. 29, figs. 14 and 15). Posterior margins of the eighth sternite (8ths) scalloped, the greatest indentation being at its mid-point (v). The coxites of the ninth (9th) are extended anteriorly and posteriorly into arms, the anterior pair extend under the eighth sternite and the posterior pair are flexed laterad at their caudal ends. The styli (sty) consist of two crescent-shaped lobes, which bear six to eight rigid spines on each of their caudal margins (s). The anal opening (au) is located between the folds of the proctiger.

Habits.—This species has a wide range in Utah and Colorado. It is found from the lower Sonoran to the Transition zones. They are especially numerous in the sage brush, *Artemisia tridentata*, regions of the upper Sonoran zone. Field notes show that certain specimens were found copulating in that type of locality. Other specimens were found on the flowers of *Cleome sp?*.

Published records for Utah.—None.

New records.—Flaming Gorge, Green River; Douglas, Uinta County, Utah. (First Zoological Expedition, summer 1926).

Monticello; St. George, Utah, (Tanner). Mesa Verda National Park, Colorado; House Rock Valley, Arizona, (Second Zoological Expedition, summer 1927).

Stenopogon modestus Loew

1866. *Stenopogon modestus* Loew, Berl. Ent. Zeit., x, p. 26 (Cent., VII, 46).

Length, Male and female, 26, to 31 mm. Mystax and beard straw-colored to white. Head generally with a sparsity of bristles. No black ones. Antennae black. Thoracic dorsum apparently bare, but covered with a fine brown pile; the pleura and pectus with prominent straw-colored bristles. Femora reddish brown; tibia and tarsi light brown; bristles of the legs, yellowish to white. Wings almost hyaline, a little smoky; fourth posterior cell open. Abdomen long, reddish black in ground color, clothed with reddish brown pile on dorsum and white laterally; segments six and seven void of pile on the dorsum.

Genitalia.—Male (Pl. 29, figs. 16 and 17). Eighth abdominal segment membranous (8ths and 8tht), ninth sternite (9ths) triangular, the caudal lobe of which bears several strong bristles. Ninth tergite (9tht) strongly curved ventrad. Lateral plates (g) ovate, the posterior ends of which are drawn into necks, these become truncated. Dorsal plates (a) capitate, extending caudad beyond the aedeagus, Proctiger (p) of the tenth segment (10th) consists of two small triangular plates which surround the anus (au), the anterior part of the tenth is membranous. Aedeagus (x) is relatively short and pointed, extending caudad to the end of the lateral plates.

Female (Pl. 29, figs. 18 and 19). Caudal margin of the eighth sternite (8ths) divided at its median point, forming a V shaped indentation. The vaginal opening is under this indentation (v). The coxites (c) of the ninth are combined into one large ventral plate, its caudo-mesal margin extending into two small lobes. The styli (sty) are sub-ovate and bear six to seven strong spines near their porterior margins. The proctiger (p) is a narrow chitinized band at the caudal margin of the tenth (10th). This is covered with rather strong bristles. The anterior part of the tenth is membranous.

Habits.—This species has a very wide distribution throughout the state and can be found in great numbers at certain times of the year. According to different collectors' field notes this species

is found almost invariably in connection with areas of *Pinus scopulorum*. One specimen was taken at an elevation of 8000 feet. The author has seen these flies preying upon their own kind as well as small Hymenopterous insects. Practically all of the fifty specimens in the Brigham Young University collection were taken in the upper Sonoran and Transition zones. None are reported from the Lower Sonoran or Alpine zones.

Published records for Utah.—None.

New records.—Wellsville Canyon; Burnt Fork, Utah-Wyoming Line; Flaming Gorge, Green River; Douglas, Uintah County, Utah. (First Zoological Expedition, summer 1926.) Bears Ears, Elk Ridge; Bryce Canyon; Lasal Mountains; Natural Bridges, Utah. Also Rim Grand Canyon; Mesa Verda National Park, Colorado and Kiabab Forest, Arizona. (Second Zoological Expedition, summer 1927). Aspen Grove, Provo Canyon, Utah, (Tanner).

Stenopogon consanguineus Loew

1866. *Stenopogon consanguineus* Loew, Berl. Ent. Zeit., x, p. 27 (Cent., VII, 48).

Length, male and female, 16-23 mm. Head black in ground color, covered with pale brown bloom. Mystax and pile sordid yellowish-white to brown; dark bristles on the vertex. Antennae black. Thorax black in ground color, covered with a dense bloom; dorsum covered with short pile and yellowish-white bristles; median markings of the notum very distinct. Legs with femur black except at its distal end, which is reddish-brown; tibia brown throughout; tarsi yellowish-brown; hair and bristles of femora dark brown, of tibia and tarsus, light yellow to white. Wings subfucous, fourth posterior cell open. Abdomen black, clothed with fine yellowish hair and bristles.

Genitalia.—Male (Pl. 29, figs. 20 and 21). Eighth abdominal segment (8ths and 8tht) membranous, ninth sternite (9ths) very broad, divided posteriorly into two lateral lobes, bristles prominent on its lateral and cuadal margins. Ninth tergite (9tht) narrow, tapering toward its caudal end. Lateral plates (g) broad ovate, definately dentate on the caudal margins. Dorsal Plates (a) terminating in a blunt spine, directed meso-caudad. Proctiger (p) of the tenth segment (10th), broad. Aedeagus (x) short, arising from a wide base.

Female (Pl. 29, figs. 22 and 23). Posterior margin of eighth sternite (8ths) with median indentation, forming two small lobes.

The vaginal opening (v) is located under this indentation. The coxites of the ninth (c) are subquadrangular, extending into arms posteriorly, these arms curve laterad. The styli are crescent shaped, the lateral anterior margins being concave. Each bears a row of eight strong spines (s) on its caudal margin. The proctiger (p) of the tenth is a narrow chitinized, marginal band. The anal opening (au) is located between the two plates of the proctiger, at their most dorsal point.

Habits.—This species is almost always found in canyon situations, associated with mountain meadows of grass-lands. Certain of our specimens were taken at an elevation of 8000 feet. One specimen was taken on the shores of Great Salt Lake. Nothing is known of their feeding habits.

Published records for Utah.—None.

New records.—Salt Air; Wellsville Canyon; Logan Canyon; Summit Laketown Canyon, Utah. (First Zoological Expedition, Summer 1926). Keetly, Utah, (O. W. Olsen). Fort Bridger, Wyoming. Ute Mountain, Colorado, (Tanner).

Stenopogon californiae (Walker)

1849. *Dasypogon californiae* Walker, List, Br. Mus., II, p. 322.
1909. *Stenopogon californiae* Back, Trans. Am. Ent. Soc., XXXV, p. 194.

Length, Male and female, 16-21 mm. Face thinly clothed with a fine depressed golden pile, silvery reflection; front and occiput yellowish pruinose. Proboscis, palpi and antennae, black. Thorax brownish pruinose; prothorax clothed with a dense light pile, dorsal stripes not prominent in any specimens; bristles of scutellum fulvous. Legs deep yellow except the basal parts of each femora which are black. Wings with dark tinge except the proximal portion of the anal cell and squama in the male, which are milky white; fourth porterior cell wide open, anal cell open. Abdomen polished black, often obscured by the grayish bloom, except on the last two segments. Male genitalia red to black; last two segments of the female usually red, bearing red spines.

Published records from Utah.—Recorded by Bach from Beaver Creek Hills, Beaver Co., Utah.

New records.—None.

Note.—There are no specimens of this species in the Brigham Young University collection. The above description is taken from E. A. Back.

Scleropogon Sp.?

Length of female, 20 mm. Vesture of the head entirely white, consisting of a dense silvery bloom. Thorax brown in ground color, obscured only in a few small patches on the dorsum. Wings hyaline; third longitudinal vein with a distinct stump. Halters pale yellow. Legs light brown, darker on their anterior sides. Bristles and hair of legs white except on the extreme points of the tarsi. Abdomen long, pollinose; segments seven and eight distinctly darker. Genitalia black; seven strong spines on each margin of the styli.

Habits.—The one specimen of the Brigham Young University collection was taken in a typical upper Sonoran locality.

Published records for Utah.—None.

New record.—Douglas, Uinta County, Utah, (Tanner).

Heteropogon ludius (Coquillett)

1893. *Anisopogon ludius* Coquillett, Canad. Ent., xxv, p. 20.

Length of male, 18 mm. Vesture of head silvery gray; bristles of mystax white above, dark below; beard white. Antennae and palpi clothed with white hair. Thorax grayish brown in ground color, of different shades, clothed with light bristles and a white fine bloom, silvery in appearance. No definite thoracic markings. Scutellum exclusively with white hair and bristles. Legs dark brown; tibia lighter than tarsi or femora. Wings hyaline, characterized by a small cell located between the distal and posterior cells; veins dark brown to black.

Genitalia.—Male (Pl. 29, figs. 24, 25). Eighth tergite (8tht) collar shaped, its anterior margin extending under the seventh tergite and the posterior margin overlapping the ninth tergite. Eighth sternite (8ths) lenticular, very narrow, not extending to the pleural margins. Ninth tergite (9tht) ovate. Ninth sternite (9ths) divided along its meson by a narrow band of membrane; bristles strong on its caudal margins. Lateral plate (g) widest at the middle, extending into a spine at the caudo-ventral margin. Dorsal plate (a) ending in a chitinized hook. Aedeagus (x) three-parted, short and blunt, barely extending caudad beyond the ninth sternite.

Habits.—This specimen was taken in a small patch of blooming milkweed, *Asclepias speciosa,* and thistle, *Cirsium sp.* It was apparently feeding upon certain small Hymenoptera that visited these flowers.

Published records for Utah.—None.

New record.—Sheep Creek, Daggett County, Utah, (C. J. D. Brown).

Dasyllis fernaldi Back

1904. *Dasyllis fernaldi* Back, Can. Ent., XXXVI, p. 290.

Length, male and female, 16 to 19 mm. Head black in ground color; mystax mostly dark; beard yellowish white. Tubercle and palpi bearing a few strong black bristles. The third segment of the antennae having a distinct groove on its inner side, near the distal end. Thorax black, clothed dorsally with pale yellowish bristles in the female, reddish in the male. Legs black, the hair and bristles principally black in the female, pale yellow in the male; femora apparently swollen; tarsal pads large. Wings subfuscous, more so near the margins of the veins (Plate 4, fig. 66). Abdomen wide, much flattened, dark to black in ground color, clothed with a dense growth of dark yellowish to red hair. The male of this species is of a much darker red color than the female.

Genitalia.—Male (Pl. 29, figs. 26, 27). The male genitalia of this species is inverted, the anal opening being ventrad to the aedeagus and the lateral plates. Eighth tergite (8tht) is represented by a small sub-cordate sclerite, symmetrical as to form but not as to position. Ninth sternite (9ths) forming the upper shield of the genital chamber, notched at the origin of the dorsal and lateral plates, terminating in a pointed lobe on its dorsocaudal margin. Ninth tergite (9tht) ovate, the caudal margin concave, the lobes on each lateral border bearing three long setae. Lateral plates (g) long and narrow, widest at their distal ends and directed meso-caudad. Dorsal plates (a) articulated to the dorsal edge of the lateral notch, they are directed dorsally so that their terminal claws extend out between the two plates of the ninth sternite. The aedeagus (x) is a chitinizd tube terminating in three slender prongs, each of these are capable of transmitting seminal fluid. The tenth abdominal segment (10th) consists of two sets of plates, the proctigers (p), those directly around the anal opening (au) and the paraprocts (pp) articulating near the caudal margin of the ninth tergite, the plates of the paraprocts act as a support to the aedeagus at the point where the aedeagus divides into three prongs.

Female (Pl. 29, figs. 28, 29). Eighth sternite (8ths) notched on each lateral margin near its posterior end, forming two small lateral lobes, the sternite projects into a long median lobe caudad from these notches. The vaginal opening (v) is directed under this lobe. There is a narrow chitinized band that crosses under the eighth sternite in the proximity of its lateral lobes. The anterior part of the ninth is membranous, the posterior part is one long dorsal plate, the valvifer (vf) which bears two ventral, clavate projections, the coxites (c). The tenth consists of two membranous lobes (p), between which is the anal opening (au).

Habits.—All the specimens of this species were collected in the vicinity of free running water. A specimen collected by the writer was found associated with two species of Bremidae. Another was found resting on *Geranium fremonti.*

Published records for Utah.—None.

New records.—Riverdale; Logan Canyon; Sheep Creek, Dagget County, Utah. (First Zoological Expedition, summer 1926). Bears Ears, Elk Ridge, Utah, and Mesa Verda National Park, Colorado. (Second Zoological Expedition, summer 1927.) Provo, Utah, (Tanner).

Deromyia bigoti (Bellardi)

1891. *Sarcopogon bigoti* Bellardi, Saggio Ditt. Mess., II, p. 70. Back, E. A.
1909. *Deromyia bigoti* Back, Trans. Am. Ent. Soc., XXXV, p. 357.

Length, male and female, 30 to 35 mm. Mystax thin, yellowish to white; bristles of occiput yellow. The antennae and the palpi are deep yellow, the former being clothed with black hair and the latter with pale yellow. Thorax broad, robust, with two dorsal stripes of reddish-brown to black; bristles of the thoracic dorsum and scutellum, black. Abdomen strong, of a pale golden pruinose; bristles of the first abdominal segment yellowish. There is a small oblique black spot on the anterior, lateral margins of segments two to five in female and two to six in the male. Wings long and narrow.

Genitalia.—Male (Pl. 28, figs. 10, 11). Eighth abdominal segment membranous (8th). Ninth sternite (9ths) triangular in shape, with the base anteriorly. Ninth tergite (9tht) long, broadest at the base, extending caudad to the posterior margin of the tenth. Lateral plates (g) broad at the base, with the posterior end drawn out into a narrow neck, which becomes abruptly truncated. Each lateral plate bears one strong spine on its mesoventral margin. Dorsal plates (a) are dialated posteriorly and are located dorso-mesad of the lateral plates. Tenth segment composed of two chitinized plates (p), one located on each side of the anal opening (au); the anterior part of the tenth is membranous. Aedeagus (x) pointed and short, not extending to the end of the lateral plates.

Female (Pl. 28, figs. 7, 8, 9). Eighth sternite (8ths) with a shallow V shaped indentation at the meson of its posterior margin. The vaginal opening (v) is directed under the eighth sternite at this point. The coxites (c) of the ninth consist of two small membranous lobes, chitinized only on their posterior margins. Styli semi-circular to ovate in outline, bearing six very rigid spines on each of their caudo-ventral margins. The tenth

abdominal segment (10th) is composed of two lobes, the posterior ends of which are directed caudo-laterad; the anal opening is situated between these two lobes.

Habits.—All of the specimens in the Brigham Young University Collection were taken in the lower Sonoran zone. Nothing is known of their feeding habits.

Published records for Utah.—Salt Lake City (C. W. Johnson).

New records.—St. George, Utah, (Tanner).

Proctacanthus milbertii Macquart

1838. *Proctacanthus milbertii* Macquart, Dipt. Exot. I, 2, p. 124.

Length, Male and female, 28 to 34 mm. Mystax yellowish white; beard almost white; front clothed with a fine silvery bloom. Palpi black, with black hair. Thorax gray-pollinose; markings of the dorsal mesothorax very distinct; bristles predominately black. Scutellum with mostly black bristles also a few white ones. Legs brown in ground color, covered with fine white hair also bearing several rows of strong black spines. Wings long, extending well back over the abdomen, almost hyaline. Abdomen brown, grayish in appearance, covered with a fine gray hair and pollen.

Genitalia.—Male (Pl. 29, figs. 30 and 31). Eighth abdominal segment membranous. Ninth sternite (9ths) sub-quadrangular, widest at its posterior margin. Ninth tergite (9tht) long, extending far beyond the tenth, it is widened anteriorly and posteriorly making both dorsal and ventral margins concave. Lateral plates (g) grooved dorsally and ventrally at their posterior ends. Each groove is surrounded by many very short rigid spines. Dorsal plates (a) articulating on the posterior margins of the ninth sternite, each is projected into a long, narrow arm. Tenth segment (10th) extends dorso-caudad through the dorsal concavity of the ninth tergite. The two plates of the proctigers completely surround the anal opening (au). Aedeagus (x) divided into two tubes, which extend a little beyond the caudal margins of the lateral plates.

Female (Pl. 29, figs. 32 and 33). Eighth sternite (8ths) much lengthened, extending far under the ninth, and bears a deep groove in the middle of its posterior margin. The vaginal opening (v) is directed between the eighth sternite and the ventral part of the ninth coxite. The coxite (c) of the ninth (9th) is one continuous sclerite, there being a dorsal anterior plate and a ventral posterior plate connected on the sides by a narrow chitinizd band. The styli (sty) are crescent shaped, bearing two or three rows of strong spines (s) on their caudo-ventral margins. The tenth (10th) is entirely membranous, the anal opening (au) occurs between the two lobes of the proctiger (p).

Habits.—The two specimens of our Collection were taken in the lower Sonoran zone.

Published records for Utah.—None.

New record.—St. George, Utah, (Tanner).

Proctacanthus arno Townsend

1895. *Proctacanthus arno* Townsend, Proc. Cal. Acad. Sci., IV, p. 599.
1911. *Proctacanthus arno* Hine, Ann. Ent. Soc. Am., Vol. IV, p. 161.

Length, male and female, 28-36 mm. Mystax white, usually with a few black bristles beneath; beard white. Palpi black, with black and white bristles. Whole body grayish-brown pollinose. Thorax with usual markings. Scutellum with many black bristles and a few white ones. Legs dark in ground color; femora almost black before and brown behind; tarsi and tibae same as femora in color. Wings hyaline, some veins faintly margined with brown. Abdomen rather slender; male genitalia elongate, longer than the last two abdominal segments. Female genitalia usually shining black with short white hairs also with styli bearing rows of strong black spines on their margins.

Note.—The above description borrowed from Hine.

Published records for Utah.—J. S. Hine records this species from Utah, but no definite locality was given.

New rocords.—None.

Erax baratus (Fabricus)

1805. *Dasypogon barbatus* Fabricus, Syst. Antl., p. 169.

Length, male, 16 to 20 mm., female 15 mm. Wing expanse of male 24 to 28 mm. vesture of head, white to pale yellowish. No black bristles in the mystax or on the palpi. Thorax pale pollinose to olive, of different shades, markings usually obscure. Scutellum with strong yellowish bristles at margin and with a sparsity of pile on the disc. Femora black in ground color, obscured by white pollen and hair; tibiae light brown except at apex, which is capped with black. Tarsi predominantly black. Bristles of legs white and black mixed. Wings slightly yellowish, almost hyaline; costa not dialated; anterior branch of third vein with a distinct stump, variable in length but usually shorter than in *Erax interruptus*. The wing is wider than in *Erax stamineus*. Dorsum of first and second abdominal segments, pale pollinose, with a usual very small black spot on each side of the second. Segments, three, four and five largely black, with a pale pollinose stripe dividing the two dorsal halves. Segments, six and seven silvery.

Genitalia.—Male (Pl. 29, figs. 34 and 35). Eighth tergite (8tht) membranous. Eighth sternite (8ths) narrow, extending laterad to the anterior margin of the ninth tergite. Ninth tergite (9tht) long, dialated in the middle so as to have both its dorsal and ventral margins convex, posterior margin articulating with a small sclerite, the paraproct (pp). Ninth sternite (9ths) divided into two sub-triangular plates, each widely separated from the other by the lateral plates and the aedeagus. Lateral plates weakly chitinized, located on each side of the aedeagus. Dorsal plates (a) long and extremely narrow, each bearing a strong spine on the inner margin at its narrowest point. Tenth segment (10th) short; the plates of the proctiger (p) extending above the convexity of the ninth tergite. Anal opening (au) small. Aedeagus (x) divided into three projections.

Female (Pl. 30, figs. 36 and 37). Eighth sternite (8ths) long, extending caudad to the end of the dorsal coxite, its posterior margin is deeply notched forming two lateral lobes, one on each side of the vaginal opening (v). The coxites of the ninth are continuous; the narrow arms are projected from their caudo-ventral margins under the tenth segment, these are directed mesad so as to touch at their posterior ends. The styli are obsolete. The tenth (10th) consists of two small lobes, the proctigers (p), which extend barely beyond the ventral arms of the coxite. The anal opening is located between these two lobes.

Habits.—Specimens of this species were collected in various situations. Field notes show that two were taken on the sandy shores of the Colorado River, another perched upon rabbit brush, *Chrysothamnus sp.*, and a fourth was captured on the blossoms of *Cleome sp.* This species is the most common of the genus *Erax*. It is found to occur in nearly all parts of the United States. Our specimens were all taken in Southern Utah.

Published records for Utah.—None.

New records.—Moab; Bluff, San Juan River; Green River, Utah. (Second Zoological Expedition, summer 1927). St. George, Utah, (Tanner).

Erax interruptus (Macquart)

1834. *Asilus interruptus* Macquart, Hist. Nat. Ins. Dip., I, p. 310.

Length, female 22 to 27 mm. Head brown in color; mystax and beard pale yellow; bristles of the palpi largely black. Thorax predominantly gray pollinose, with a dark mid-dorsal stripe narrowly divided anteriorly. Scutellum with a row of yellowish white bristle on its margins. Legs reddish-brown, darker on

undersides, covered sparsely with fine white hair; bristles dark brown to black. Wings reddish hyaline; anterior branch of third vein with a prominent stump. Abdomen dark brown in ground color, almost black in some specimens, yellowish gray pollinose on the sides of the segments. Segments six and seven wholly pollinose.

Genitalia.—Female (Pl. 30, figs. 38 and 39). Eighth sternite (8ths) very long, extending caudad to the middle of the ventral arms of the coxites. Its posterior margin is deeply notched at the meson, forming two lobes, one on each side of the vaginal opening (v). The ninth is composed of one sclerite, the larger part of which is dorsal. It is narrow and two pointed arms are projected from its caudo-ventral margins under the tenth segment. The tenth consists of two elongate lobes, much longer than in *Erax barbatus*. These extend beyond the ventral coxites. The anal opening (au) is situated between these lobes at the posterior margins of the proctiger (p).

Habits.—This species was only found to occur in the lower Sonoran zone in Southern Utah.

Published records for Utah.—None.

New records.—St. George, Utah, (Tanner); Bluff, Utah. (Second Zoological Expedition, summer 1927).

Erax stamineus Williston

1885. *Erax stamineus* Williston, Trans. Am. Ent. Soc., XII, p. 68.

Length, male and female 19 to 25 mm. Head densely clothed with hair; mystax and beard pale yellow; palpi strongly yellow; bristles of the front and occiput mixed yellow and black. Thorax extremely convex; dorsum of the mesothorax with black bristles. Scutellum bears a marginal row of long yellow and black bristles. Legs robust; femora black; tibia and tarsus reddish brown, darkening apically; legs bristles black, hair pale yellow. Wings hyaline and comparatively narrow; third vein distinctly furcate before the midpoint of the anterior cross vein and the base of the second posteror cell; stump about as long as the basal portion. Abdomen with dorsum of first and second segments medianly yellow pollinose; third and fourth densely clothed with white hair and pile; segment five silvery pollinose; segments six and seven silvery pollinose without pile.

Genitalia.—Male (Pl. 30, figs. 40 and 41). The eighth abdominal segment (8th) is represented by two angular sclerites, located on each side. Ninth tergite (9tht) long, greatly widened at

its posterior end. Its caudal margin articulates with a small sclerite, the paraproct (pp). The ninth sternite (9ths) is divided into two long pointed plates, each has a small, shallow notch on the meson of its dorsal margin. Lateral plates (g) weakly chitinized, situated on each side of the aedeagus. Dorsal plates (a) very narrow, extending caudad to the end of the lateral plates, these are strongly chitinized except the posterior tips. Tenth segment short (10th), obscured by the ninth tergite. The anal opening (au) is located at the posterior margins of the proctiger (p). Aedeagus three-parted, extending only a short distance beyond its sheath.

Habits.—This species, although not previously recorded from Utah, has been taken in both Wyoming and Montana. It is found to occur from the northern boundary of our state to Bryce Canyon of the south. All of the collected specimens were captured in rather barren situations or along the road sides. Three specimens were found associated with *Cicindela oregona* Lec. and *Cicindela p. imperfecta* Lec.

Published records for Utah.—None.

New records.—Farr West; Flaming Gorge, Green River, Utah. (First Zoological Expedition, summer 1926). Circleville; Bryce Canyon, Utah. (Second Zoological Expedition, summer 1927.)

Erax subpilosus Shaeffer

1916. *Erax subpilosus* Shaeffer, Jour. N. Y. Ent. Soc., XXIV, p. 67.
1919. *Erax subpilosus* Hine, Ann. Ent. Soc. Am. Vol., XII, p. 118.

Length, male and female, 22 to 27 mm. Head grayish-white pollinose; beard and mystax white. Thorax black, faintly pollinose; dorsum and scutellum covered with long black hair; plurae covered with long white hair. Abdomen black; first to third segments with black hair and bristles; fourth with white and black; fifth, sixth and seventh densely white pollinose. Venter grayish-white pollinose. Wings pure hyaline; third vein furcate; stump rather short. Hypopygium of male, black, clothed with short white hairs. Hypopygium of female rather long, longer than the last three segments of the abdomen.

Published records for Utah.—Recorded by Hine from Beaver Creek Hills, Beaver County, Utah.

New records.—None.

Note.—Description from Hine.

Mallophora fulviventris Macquart

1849. *Mallophora fulviventris* Macquart, Dipt. Exot. Suppl., IV, p. 77.

Length, male and female. 13 to 17 mm. Body compact. Vesture of head pale yellowish; front shining black, void of hair; lower mystax and beard very thick. Palpi long, covered with a long yellow hair. Antennae bearing a few black bristles. Thorax black, clothed with fine velvety pile and a row of black bris-Legs dark brown to black; femur dialated; tibiae bearing row of the prothorax and in scattered patches on the plurae of the metathorax. Scutellum covered with a dense growth of yellow hair. Legs dark brown toblack; femor dialated; tibiae bearing row of black bristles on their outer surfaces. Abdomen black, uniformly clothed with long yellow hair, lighter on the venter.

Genitalia.—Male (Pl. 30, figs. 44 and 45). Eighth abdominal segment (8tht and 8ths) membranous. Ninth tergite (9tht) long, extending beyond the tenth, widest at its posterior end. Ninth sternite (9ths) divided into two sub-triangular plates; the posterior part of their ventral margins are concave. The lateral plates (g) articulate in the anterior part of these concavities; they are narrow and blunt. Dorsal plates (a) obsolete. The tenth segment (10th) widens posteriorly; caudal margin with a tiny notch in the middle. The anus (au) is located under the proctiger (p) at this point. Aedeagus (x) bifurcate, the two branches of which extend caudad to the posterior end of the tenth.

Female (Pl. 30, figs. 42 and 43). The middle posterior margin of the eighth tergite (8tht) is extended into a narrow, rectangular projection. Posterior margin of the eighth sternite (8ths) deeply notched, forming two terminal lobes. The coxite (c) of the ninth (9th) consists of two dorsal plates, which have projecting from their caudo-ventral margins, two rather small dialated arms. These extend under the tenth. The tenth (10th(is composed of two dorsal plates divided by a membranous area. Anal opening (au) lies between the folds of membrane, mesad of each plate of the proctiger (p).

Habits.—All of our specimens were taken in the lower Sonoran Zone.

Published records for Utah.—None.

New records.—St. George, Utah, (Tanner).

Mallophora guildiana Williston

1885. *Mallophora guildiana* Williston, Trans. Am. Ent. Soc., XII, p. 60.

Length, male and female, 10 to 12 mm. Head shining black in ground color; vertex much depressed; tubercle inconspicuous.

Vesture of head and body, white; mystax and beard thick. Thorax black, clothed with white hair and bristles; plurae and venter more densely clothed than the dorsum; no thoracic markings. Legs with coxae black; femora and tibiae yellow except for a black cap on their posterior ends; tarsi black. Wings subfuscous, light brown in color; veins fine and of a dark brown color; small cross-vein between the third and fourth longitudinal cells; veins four, five and six become almost obsolete near the wing margin. Abdomen black, covered with yellowish-white hair, this is much thicker at the posterior margins of each segment.

Genitalia.—Male (Pl. 30, figs. 46 and 47). Eighth abdominal segments normal. Ninth tergite (9tht) long, quite uniform in width, inner margins concave. Ninth sternite (9ths) divided, each plate being widest at its base and concave on its inner margin. Lateral plate (g) continuous, exposed ventrally through the concavity of the ninth sternite, it is deeply notched on its posterior end. Tenth (10th) consists of two chitinized bands on its lateral margins separated by membrane. Aedeagus (x) broad and long divided into three branches, just caudad of the lateral plates. It extends far beyond the ninth and tenth segments.

Habits.—Specimens of the Brigham Young Collection were taken only in the lower Sonoran Zone.

Published records for Utah.—None.

New records.—Santa Clara, Utah, (Tanner).

Promachus bastardii (Macquart)

1838. *Trupanea bastardii* Macquart, Dipt. Exot., I, 2, p. 104 [U. S.].

Length, male 24 mm. Mystax distinctly yellow; beard pale yellow; no black bristles in the mystax or on the palpi. Thorax brown pollinose of different shades, with distinct markings on the dorsum; dorsal bristles mostly black; venter clothed with white hair. Scutellum with a row of black bristles on its posterior margin. Legs chocolate brown, darker on the under sides; bristles dark brown to black, hair white. Wings brownish, hyaline, pointed at apex; three small cross-veins between the posterior branch of the second longitudinal and the third longitudinal veins. Abdomen brown in ground color, lighter at the posterior margin of each segment; abdominal bristles brown to black, thicker on the margins of the segment.

Genitalia.—Male (Pl. 30, figs. 48 and 49). Eighth tergite (8tht) membranous. Eighth sternite (8ths) composed of two triangular plates, situated on each side of the posterior lobe of the seventh sternite. Ninth tergite (9tht) broad, quite uniform

in width throughout its entire length and extends caudad beyond the tenth. Ninth sternite (9ths) divided, its anterior margins are almost continuous, and is deeply notched on each meso-ventral margin. The lateral plates (g) are the two narrow arms which articulate with the ninth sternite. The tenth (10th) is composed of two membranous lobes, weakly chitinized on their caudal margins, each is notched on its posterior mesal margin. The lobe of the tenth which lies above the anus (au), is the proctiger (p) and the one below, the paraproct (pp). Aedeagus long, very stout, and is divided into three well developed seminal tubes (x).

Habits.—Nothing is known of the habits of this species.

Published records for Utah.—None.

New record.—Farr West, Utah, (C. Cottam).

Promachus nigripes Hine

1911. *Promachus nigripes* Hine, Ann. Ent. Soc. Am., IV, p. 170.

Length, male and female, 25 to 32 mm. Mystax and beard white; occipito-orbital bristles black; palpi black, covered with much black hair. Antennae dark to black. Thorax dark gray pollinose; no distinct markings on the dorsum of the mesothorax; vesture largely black. Legs strong, black covered with black hair and bristles, at times a few white hairs on the femora. Wings hyaline, no shading in the first submarginal cell. When at rest the wings fold closely over the abdomen. Abdomen banded with black and white, from above the black bands widen anteriorly; venter and plurae white pollinose.

Genitalia.—Male (Pl. 30, figs. 52 and 53). Eighth abdominal segment membranous (8tht). Ninth tergite (9tht) long, with a widened anterior half and a more or less constricted posterior end. Ninth sternite (9ths) continuous, consisting of one broad ventral plate. Lateral plate (g) subtriangular, articulating with the lateral, posterior margin of the ninth sternite. Each lateral plate has a distinct flap on its posterior margin. Dorsal plates (a) corresponding to the lateral plates in *Proctacanthus milbertii* (Pl. 29, figs. 30, 31). They consist of two lobes the margins of which fuse together, forming a small cavity. The aedeagus (x) consists of two separate tubes, articulating with the posterior margin of the ninth. The posterior ends of the aedeagus coil mesad.

Female (Pl. 30, figs 50 and 51). Eighth tergite (8tht) normal. Eighth sternite (8ths) somewhat elongate, there is a V-shaped indentation at its caudal end dividing it into two long, narrow

lobes. The vaginal opening (v) is directly under the posterior end of the eighth sternite. The ninth coxite (c) is continuous, consisting of a large anterior dorsal plate, the caudo-ventral margins of which extend into arms, projecting caudo-ventrad under the tenth. Styli obsolete. The tenth (10th) is divided into two ovate lobes, separated dorsally by a narrow membranous connection. The anal opening (au) is located on the caudo-dorsal margins of the proctiger (p).

Habits.—Practically all of our specimens were caught in rocky hill-side situations. They seem to prefer to perch on the surface of rocks when at rest or when eating newly caught prey. The male specimens of our collection are much larger than the females.

Published records for Utah.—None.

New records.—Beaver City, Utah, (Tanner). Mesa Verda National Park, Colorado. Kaibab Forest, Arizona. (Second Zoological Expedition, summer 1927.)

Promachus aldrichii Hine

1911. *Promachus aldrichii* Hine, Ann. Ent. Soc. Am., IV, p. 171.

Total length, Male and female, 28 to 30 mm. Mystax and beard white; palpi black with white hair. Dorsum of the mesothorax with black hair and bristles. Dorsum of the prothorax gray pollinose. Legs black, clothed with black and white hair and black bristles. Wings clear hyaline, no shadow in the first submarginal cell. Abdomen black in ground color, gray pollinose on plurae and venter, clothed everywhere with a rather short white hair. Hypopygium silvery pilose above. The abdomen is not banded as in *Promachus nigripes.*

Published record for Utah.—Cache Valley, Utah (J. M. Aldrich).

New record.—None.

Note.—Description from Hine.

Asilus lecythus Walker

1849. *Asilus lecythus* Walker, List Dipt. Br. Mus., II, p. 451.

Length, male 17 mm. Face and front covered with fine yellowish pollen or dust; mystax sparse, black above and white below; beard pale yellow. Palpi and antennae black, the former bearing white hair and the latter black. Thorax grayish-brown, middorsal stripe brown, finely divided anteriorly. Wings hyaline, showing play of colors when oriented with light. Legs with coxae colored like the sides of the thorax; femora, tibiae and tarsi dark brown, lighter at the preapical band. Abdomen dark

brown in ground color, clothed sparsely with yellowish pile; the posterior margins of each segment much lighter.

Genitalia.—Male (Pl. 30, figs. 54 and 55). Eighth abdominal segment (8tht and 8ths) membranous. Ninth tergite (9tht) long, broadest at base, its lateral surface convex. Ninth sternite (9ths) continuous, divided into two broad lobes posteriorly by a shallow indentation on its caudal margin. Lateral plates (g) small, with a very narrow projection extending mesad from near its inner, anterior margin. Dorsal plates (a) narrow, widest at their posterior ends, articulating in the angle formed by the projections of the lateral plates. Tenth (10th) extending dorsocaudad above the ninth tergite. Anus (au) situated at the caudal ends of the proctiger (p). Aedeagus, long and slender, divided into three prongs near its posterior ends. It extends caudad almost to the end of the ninth tergite.

Habits.—The two specimens of our collection were collected at an altitude of about 6000 feet.

Published records for Utah.—None.

New records.—Aspen Grove, Provo Canyon; Bryce Canyon, Utah, (Tanner).

Asilus tenebrosus Williston

1901. *Asilus tenebrosus* Williston, Biol. Cent. Am., Diptera, I, p. 328.

Length, female, 20 mm. Head of moderate size; mystax black above, white below. Antennae black; the style of the third segment as long as the rest of the antennae. Thorax almost black in ground color, yellowish to gray pollinose, varying in density; wide median stripe on the dorsum, divided anteriorly by a narrow grayish interval. Scutellum with two black bristles at apex. Legs brownish-red, with black bristles; coxae dark brown. Wings hyaline, except for a series of darkened cells near its apex and along its margin. Halters pale yellow. Abdomen approximately of the same color as the thorax, with light colored annulations, proceeded by a row of white bristles, at the caudal margin of each segment. Female genitalia very small and shining black.

Genitalia.—Female (Pl. 30, figs. 56 and 57). Eighth sternite (8ths) long, its posterior margin is deeply notched, so as to form two long, narrow lobes. The vaginal opening (v) is situated under the sternite at the anterior margin of the notch. The coxite (c) of the ninth (9th) consists of a rather long dorsal, anterior plate, whose caudo-ventral margins extend around under the tenth, where they become fused. Styli obsolete. Tenth (10th) composed of two small ovate plates the proctigers (p), these surround the anal opening (au).

Habits.—The one specimen in the Brigham Young University Collection was taken at an elevation of 9000 feet. Prof. Cockerell also reports having captured one at an elevation of 8000 feet in Pecos and Buela, New Mexico.

Published records for Utah.—None.

New record.—Kaibab Forest, near Utah-Arizona line, (Tanner).

Asilus auriannulatus Hine

1906. *Asilus auriannulatus* Hine, Ohio Nat., VII, p. 29.

Length, female, 13 to 17 mm. Mystax black, beard white. Third segment of antennae about as long as the other two combined. Thorax dark brown in ground color, with varying spots of pollen; mid-dorsal stripe black. Scutellum with several black bristles on its posterior margin. Wings pale brown, intensified near the margins. Halters yellow. Legs black and yellow, with a preapical ring on each femur. Abdomen shining black, with a golden annulus at the caudal margins of segments two to five.

Genitalia.—Female (Pl. 30, figs. 58 and 59). Eighth sternite (8ths) divided posteriorly into two lobes. The vaginal opening (v) is located directly above the eighth sternite at its caudal margin. The coxite (c) of the ninth (9th) resembles that of *Asilus tenebrosus* (Pl. 30, figs. 56-57), except that its ventral projection extends caudo-ventrad into a single ventral plate. Styli wanting. The tenth (10th) is composed of two lateral lobes, connected dorsally by a membrane. The anus (au) is located between the two plates of the proctiger, at their posterior margins.

Habits.—The specimens in our collection were taken near a running stream in a canyon situation. The writer noted that one specimen was carrying a small Hymenoptera at the time of collection.

Published records for Utah.—None.

New record.—Wellsville Canyon, Utah, (C. J. D. Brown).

Summary.

1. In this paper, twenty-two species have been treated. The male and female genitalia of sixteen species have been figured and all the parts homologized. These represent ten genera. The general morphology of one species has been studied in detail.

2. The genitalia consists of the eighth, ninth and tenth abdominal segments and their appendages.

3. The structures and appendages found in the female are:

Eighth tergite, eighth sternite bearing the vulva. The ninth tergite and sternite are modified into the valvifer, coxite and stylus. The tenth is composed of the proctiger, which in turn bears the anus.

4. The structures and appendages found in the male are: Eighth tergite, eighth sternite, ninth sternite consisting of the dorsal plates, the lateral plates and he aedeagus. The tenth consists of the proctigers and the anal opening.

5. The Asilid genitalia seems to present a new means of separating genera and species.

6. The distribution of Utah forms is more extensive, than is indicated in previous literature.

BIBLIOGRAPHY

ALDRICH, J. M., 1905..Catalogue of North American Diptera. *Smiths. Misc. Coll.*, No. 1444, XLVI, pp. 253-283.

1923..New Genera of the Two-Winged Flies of the Subfamily Leptogastrinae, of the family Asilidae. *Proc. U. S. Natl. Mus.*, LXII, 6 pp.

BACK, E. A., 1909..Robberflies of America, North of Mexico, Belonging to the Subfamilies, Leptogastrinae and Dasypogoninae. *Trans. Am. Ent. Soc.*, XXXV, pp. 137-400.

COMSTOCK, J. H., 1924..An Introduction to Entomology, pp. 840-841. *The Comstock Pub. Co.*, 1924.

ESSIG, E. O., 1926..Insects of Western North America, pp. 559-560. *Macmillan Company*, 1926.

HINE, J. S., 1909..Robberflies of the Genus Asilus. *Ann. Ent. Soc. Am.*, II, pp. 136-170.

1911..Robberflies of the Genera Promachus and Proctacanthus. *Ann. Ent. Soc. Am.*, IV, pp. 153-172.

1919..Robberflies of the Genus Erax. *Ann. Ent. Soc. Am.*, XII, pp. 104-154.

MCATEE, W. L. AND BANKS, NATHAN, 1920..District of Columbia Diptera: Asilidae. *Proc. Ent. Soc. Wash.*, XXII, pp. 1-31.

SNODGRASS, ROBERT E., 1902..The Inverted Hypopygium of Dasyllis and Laphris. *Psyche*, IX, pp. 399-400.

1904..The Hypopygium of the Dolichopodidae. *Proc. Calif. Acad. Sci.* III, pp. 274-290.

TANNER, VASCO M., 1927..A Preliminary Study of the Genitalia of Female Coleoptera. *Trans. Am. Ent. Soc.*, LIII, pp. 5-50, pls. 2-15.

WILLISTON, S. W., 1883..On The North American Asilidae (Dasypogpnonae, Laphrinae), With a new Genus of Syrphidae. *Trans. Amer. Ent. Soc.*, XI, pp. 1-35.

EXPLANATION OF ABBREVIATIONS

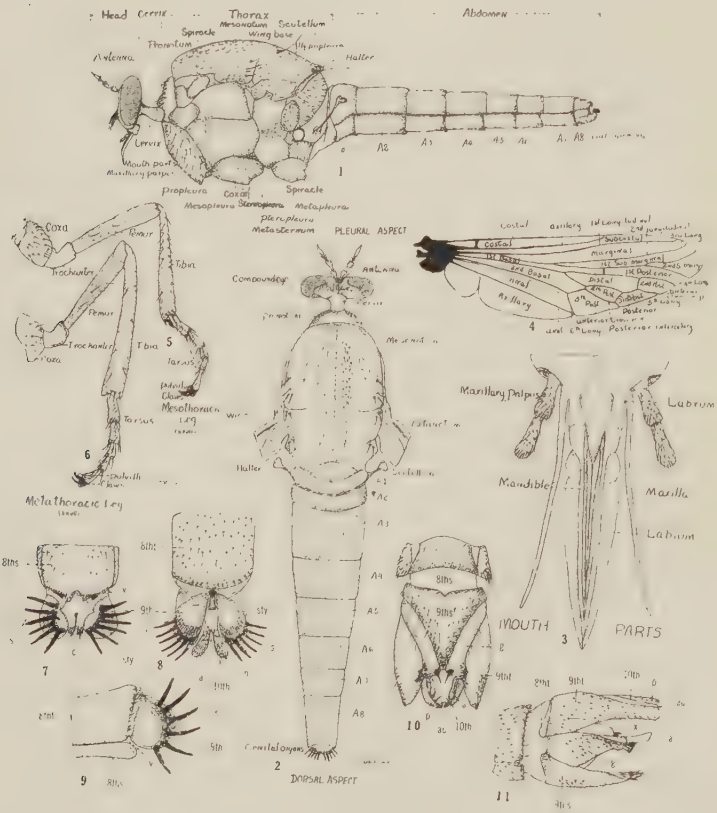
p	proctiger	v	vulva
pp	paraproct	x	aedeagus
sty	stylus	s	spines
c	coxite	8tht	eighth tergite
vf	valvifer	9tht	ninth tergite
a	dorsal plate	8ths	eighth sternite
g	lateral plate	9ths	ninth sternite
au	anus	10th	tenth segment

Plate XXVIII

GENERAL MORPHOLOGY OF ASILIDAE

Deromyia bigoti Back

Fig. 1.—Sinistral aspect of female.
Fig. 2.—Dorsal aspect of female.
Fig. 3.—Mouth parts, much enlarged
Fig. 4—Right wing of female.
Fig. 5.—Mesothoracic leg of female.
Fig. 6.—Metathoracic leg of female.
Fig. 7.—Female genitalia, ventral.
Fig. 8.—Female genitalia, dorsal.
Fig. 9.—Female genitalia, sinistral.
Fig. 10.—Male genitalia, ventral.
Fig. 11.—Male genitalia, sinistral.



BROWN—UTAH ASILIDAE

ERRATUM VOL. 54, Plates 29 and 30

The captions of these plates should be changed to read :

Pl. XXX instead of XXIX.
Pl. XXIX instead of XXX.

Plate XXIX

GENITALIA

Ospriocerus abdominalis

Fig. 12.—Ventral, male.
Fig. 13.—Sinistral male.
Fig. 14.—Ventral, female
Fig. 15.—Sinistral, female.

Stenopogon modestus

Fig. 16.—Ventral, male.
Fig. 17.—Sinistral, male.
Fig. 18.—Sinistral, female.
Fig. 19.—Ventral, female.

Stenopogon consanguineus

Fig. 20.—Ventral, male.
Fig. 21.—Sinistral, male.
Fig. 22.—Ventral, female.
Fig. 23.—Sinistral, female.

Heteropogon ludius

Fig. 24.—Ventral, male.
Fig. 25.—Sinistral, male.

Dasyllis fernaldii

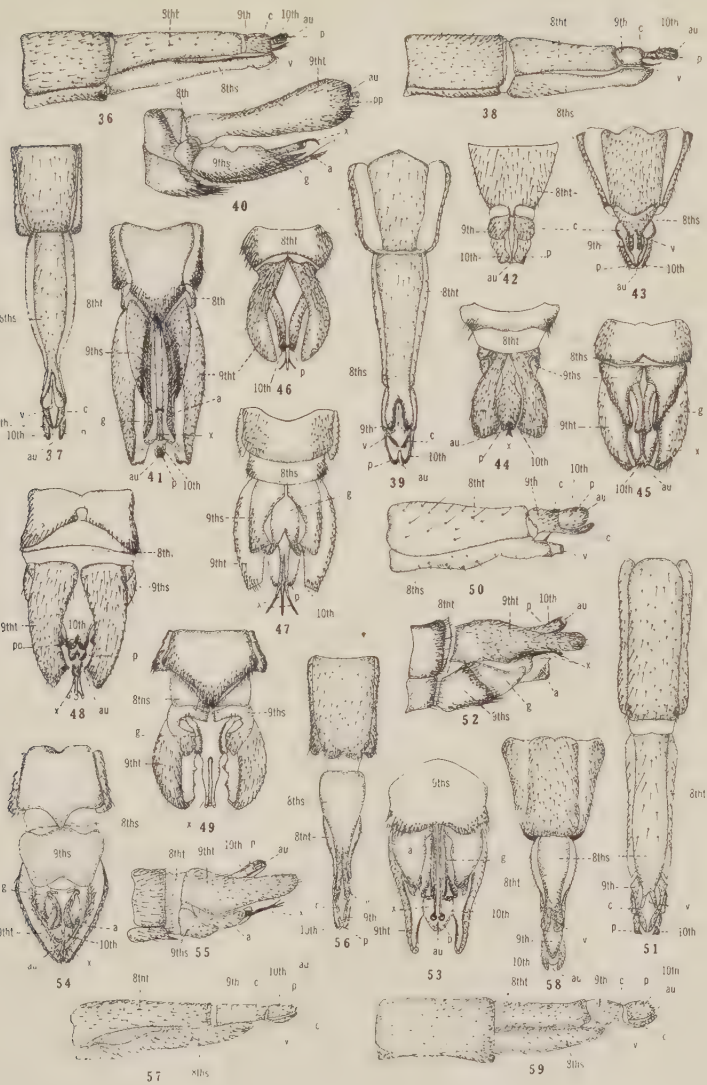
Fig. 26.—Sinistral, male.
Fig. 27.—Ventral, male.
Fig. 28.—Ventral, female.
Fig. 29.—Sinistral, female.

Proctacanthus milbertii

Fig. 30.—Sinistral, male.
Fig. 31.—Ventral, male.
Fig. 32.—Ventral, female.
Fig. 33.—Sinistral, female.

Erax barbatus

Fig. 34.—Ventral, male.
Fig. 35.—Sinistral, male.



BROWN—UTAH ASILIDAE

PLATE XXX

GENITALIA

Erax barbatus

Fig. 36.—Sinistral, female. Fig. 37.—Ventral, female.

Erax interruptus

Fig. 38.—Sinistral, female. Fig. 39.—Ventral, female.

Erax stamineus

Fig. 40.—Sinistral, male. Fig. 41.—Ventral, male.

Mallophora fulviventris

Fig. 42.—Dorsal, female. Fig. 43.—Ventral, female.

Fig. 44.—Dorsal, male. Fig. 45.—Ventral, male.

Mallophora guildiana

Fig. 46.—Dorsal, male. Fig. 47.—Ventral, male.

Promachus nigripes

Fig. 48.—Dorsal, male. Fig. 49.—Ventral, male.

Promachus nigripes

Fig. 50.—Sinistral, female. Fig. 51.—Ventral, female.

Fig. 52.—Sinistral, male. Fig. 53.—Ventral, male.

Asilus lecythus

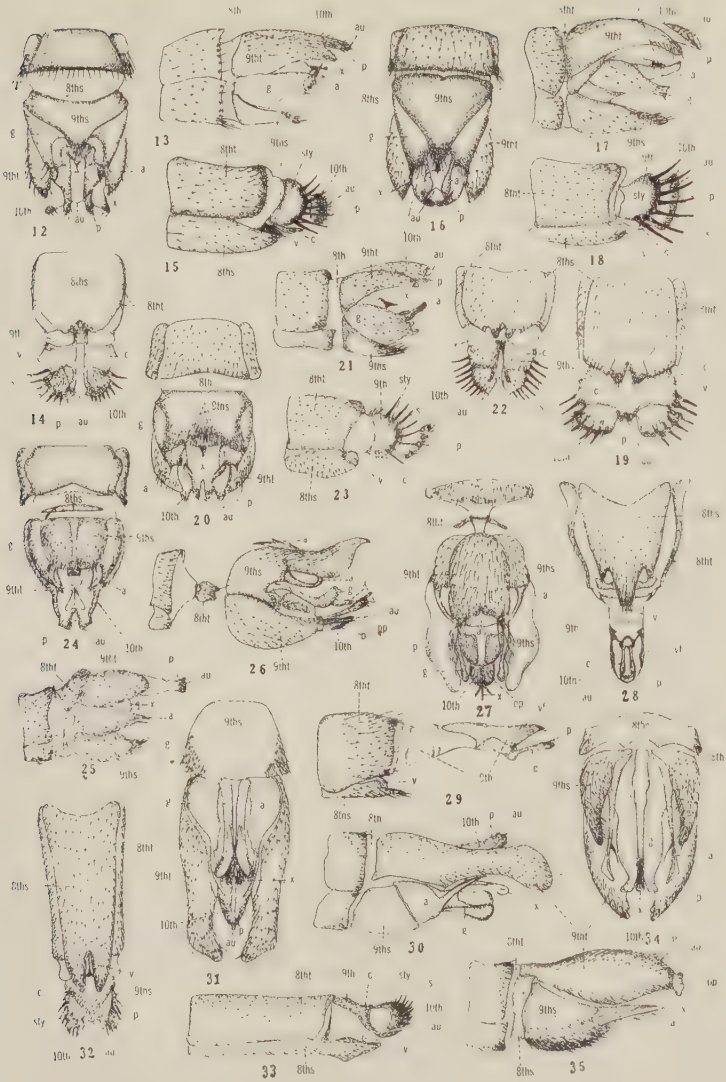
Fig. 54.—Ventral, male. Fig. 55.—Sinistral, male.

Asilus tenebrosus

Fig. 56.—Ventral, female. Fig. 57.—Sinistral, female.

Asilus tenebrosus

Fig. 58.—Ventral, female. Fig. 59.—Sinistral, female.



BROWN—UTAH ASILIDAE

SEX ANOMALIES IN THE GENUS MEGACHILE, WITH DESCRIPTIONS OF NEW SPECIES[1] (HYMENOPTERA: MEGACHILIDAE)

BY THEODORE BERTIS MITCHELL

CONTENTS

Introduction 322
Sexual dimorphism 323
Hermaphrodites 323
Gynandromorphs 324
Intersexes 324
Gynandromorphic species 325
Types of gynandromorphs 325
Records of gynandromorphs 326
Sexual dimorphism in *Megachile* 328
Female 328
Male 329
Descriptions 331
Megachile vidua Smith 332
Megachile parallela Smith 333
Megachile gemula Cresson 333
Megachile perihirta Cockerell 334
Megachile bertonii Schrottky 335
Megachile tapytensis n. sp. 335
Megachile sp. 338
Megachile intergradus n. sp. 339
Megachile dilatata n. sp. 344
Megachile chapadiana n. sp. 346
Megachile uniformis n. sp. 349
Factors affecting sex 352
Nature of sexual state 352
Sex factors 352
Genetic constitution 352
Genital glands 354
External influences 356
Experimental anomalies 358
Theories 360
Conclusions 363
Acknowledgements 376
Bibliography 377

[1] Submitted to the Faculty of Harvard University in partial fulfilment of the requirements for the degree of Doctor of Science, and published with the approval of the Director of the North Carolina Experiment Station as Paper No. 27 of the Journal Series and as Bussey Institution Contribution No. 297.

Introduction

During the course of a taxonomic study of the bee-genus *Megachile* a most interesting series of specimens anomalous as to sex have come to light. In view of the fact that previous records of such conditions in this genus have been few, the number of specimens found is quite amazing, especially as material only from North and South America has been examined. A large majority of the specimens were found in a collection made by the late Mr. H. H. Smith in Brazil, this now being in the possession of The Academy of Natural Sciences of Philadelphia. Scattered specimens from other sources were also found, and due acknowledgment of the collectors will follow the descriptions.

The study of this material has of course many limitations. All of the specimens were found in museum collections of dried material, and while the external characters are in satisfactory condition in most instances, the internal characters, which are at least of equal importance to the external, are not in such good condition due to the drying out of the soft internal tissues. The fact also that the material is not the personal property of the author and is of considerable value had to receive due consideration. Dissection of the specimens for a study of the internal tissues would damage them beyond repair in most cases, and since the value of such dissection was doubtful, because of the dried-out condition, it was not attempted except in one specimen. If a series of freshly caught material were available much might be learnd from such dissection and from a cytological examination of the reproductive and somatic tissues, but with the series at hand, a description of the external characters is all that has been attempted. Great care was exercised that the abdomen should not become detached from the thorax, for the appearance of many of them suggests a female abdomen glued to a male thorax. It was very desirable, therefore, to retain intact the natural union of these two regions.

The study of this material is also limited because of the fact that all of these are "wild" specimens and were collected by chance, by collectors who did not, at the time at least, suspect their nature. The fact of the occurrence of such anomalous

forms is of course very interesting, but the causes of these conditions are of even greater interest. What are the factors which bring about such conditions, and how does the organism react to these causal factors to produce the anomalous conditions? For a definite insight into the mechanism of their occurrence, however, an abundance of material is necessary, and if possible, means of observing them through the entire course of their development, with the various environmental factors either known or under control. This has of course been impossible here, and it also seems probable that opportunities for such observations in this group of insects will be rarely obtained in the future. But a comparison of these abnormalities with similar instances in other groups, where the causes are more or less definitely known, may give a clue to the possible causes here.

Sexual dimorphism is of course a general condition in the higher forms of life that is familiar to everyone, and also the fact that the sexes differ not only in what are known as the primary sex characters, such as the presence of ovary or testis and the associated genital organs, but also in other characters not intimately associated with the sex glands. These latter are known as the secondary sexual characters, and it is in forms that differ more markedly in these characters that anomalous conditions are more conspicuous. Such conditions that have been observed therefore, have usually been in species that are more rather than less strongly dimorphic with respect to the secondary sex characters. They quite probably occur in forms that are more nearly alike as to male and female, but they do not come to light so readily due to their inconspicuous nature.

Sexual abnormalities, in which characters of both sexes are evident in the same individual, have been known in general as hermaphrodites, but they are various in character, and one general term hardly suffices. Moreover, according to definition, the term applies only to individuals containing both ovaries and testes, and not all sexual abnormalities are of this nature. It applies more strictly to various forms that normally contain both sex glands, such as many of the Annelids, Planarians, certain of the Crustacea, the Hag-fish, etc. In some of these both

sex glands are present and functional at the same time, while in others the individual is male in the early stages, changing to female in the latter part of its existence; but in all, it is the normal condition. Thus it seems preferable to distinguish between these normal forms and those in which the characters of both sexes occur in the same individual only as an abnormal condition. Such abnormal forms are known as gynandromorphs.

There are various degrees of gynandromorphism, however, and various ways in which the division between male and female parts occurs. Numerous instances have been recorded of butterflies in which one side was male and the other female, the line of division being lengthwise of the body, and consequently, in some cases at least, with a testis on one side and an ovary on the other. The line of division is not always longitudinal, however, but may be transverse, resulting in a form with the anterior end of one sex and the posterior of the opposite sex. Such a gynandromorph would contain the sex glands of only the sex shown by the posterior parts of the body, and the dual nature of the individual would be recognizable only from the secondary sex characters. A gynandromorph, therefore, may be defined as a sexually abnormal individual in which certain portions of the body exhibit the secondary characters of one sex, and the remaining parts show those of the opposite sex, and the sex glands may be of both sexes or of only one.

But not all sexual abnormalities can be assigned as gynandromorphs. A true gynandromorph contains the two sexes in varying proportions, as shown by the secondary sex characters, but a part exhibiting maleness is definitely male, while another showing femaleness is likewise definitely female. In certain cases it has been found that an individual, instead of showing contrasting sexual characters, may exhibit an intermediate condition between the two sexes. A given organ or part, instead of being definitely male or female, is intermediate between the two. Thus it has been shown that the sexual status of an organism may vary as to degree, and that an individual of one sex may show a tendency toward the other sex in its somatic characters (Riddle, 1916; Banta, 1916; Goldschmidt, 1916). The terms intersex and sex intergrade have been proposed to apply to such conditions. An intersex, therefore, is an individual primarily of one sex, having only ovaries or testes as the case may be, while in the somatic characters a certain degree of male-

ness exists if it is a female, or of femaleness if it is a male. The degree of change toward the other sex may be very slight and observable in only one organ or part, or it may proceed to the extreme of a complete change to the other sex so far as the soma is concerned (Banta, 1916). Thus an individual would result having the sex glands of one sex, while the soma is entirely of the opposite sex. Such extreme cases would not come to our notice of course until the apparent male or female were dissected and found to contain the sex glands of the opposite sex.

While most of the recorded cases of intersexual conditions or of gynandromorphs have been shown to be abnormalities, there are a few instances on record of species in which one sex or the other, or a caste in the case of colonial insects, exhibits certain of the somatic characters of the opposite sex, or of another caste, as the normal condition. In the ants a few species have been described in which the male normally resembles the worker (erganandromorphic) or the soldier (dinergatandromorphic), the worker and the soldier being of course different forms of the female sex. In the bees also, one species (*Androgynella detersa* Cockerell) has been described in which the female normally shows the secondary sex characters of the male, being thus normally gynandromorphic. The difficulty here is in determining the normality of the condition. More will be said of this later.

It has already been indicated that gynandromorphs are various in character, differing in the manner of division of the soma into contrasting male and female parts. A classification of these various types was made by Dalla Torre and Friese (1899) in which the following types were recognized: (1) the lateral type, in which the body is divided longitudinally into right and left halves, one half beng male, the other female; (2) the transverse type, in which the body is divided into dorsal and ventral portions; (3) the frontal type, in which the line of division is across the body, with the anterior end of one sex and the posterior end of the other, or the median portion of the body of a different sex than the two ends; and (4) the

mixed (mosaic) type, in which irregular patches are of one sex and the remainder of the soma of the opposite sex. Cockayne (1915) proposes another classification based on the internal as well as the external characters as follows: (1) the genetic "hermaphrodite", in which the sex glands of both sexes are present; (2) the primary somatic "hermaphrodite", that has the sex gland or glands of one sex only, but has portions of the internal or external sex organs of both sexes present; and (3) the secondary somatic "hermaphrodite", that has the sex glands and corresponding sex organs of one sex only present, but with both sexes represented in the secondary sex characters.

Gynandromorphs have been found more frequently in the butterflies, among the insects. A possible reason for this is the conspicuous nature of many of them, especially where the males and females have entirely different colors or color patterns, and another possible reason is the greater number of collectors interested in butterflies. In the Hymenoptera such occurrences are very rare. Enderlein (1913) gives a list of seventy-eight species of Hymenoptera of which one or more gynandromorphic individuals have been recorded previously. Since this paper, thirty or more additional hymenopterous gynandromorphs have been recorded, in about as many species, a considerable proportion of them being ants and bees, but some occurring in the saw-flies and wasps. Twelve of them are bees, including four species of *Andrena* (Perkins, 1914 and 1915), two of *Hylaeus* (Perkins, 1922; Morice, 1915), one *Halictus* and one *Nomada* (Perkins, 1922), one of *Bombus* (Stockhert, 1921), one of *Osmia* (Sandhouse, 1923), one of *Dianthidium* (Hicks, 1926), and one of *Megachile* (Androgynella) (Cockerell, 1918). Twenty-one ant gynandromorphs have been recorded since 1913, an average of more than one each year, while in the bees the average has been considerably less, with only twelve recorded in fourteen years. The rarity of such occurrences is therefore apparent.

In *Megachile,* including the subgenus *Chalicodoma,* sexual abnormalities in five species have been recorded up to the present time. Gerstacker recorded a gynandromorph of the genus *Megachile* in 1861, the species being undetermined, and this is the first record in the genus. The next one recorded was

in 1892, an account of a gynandromorph of *Chalicodoma muraria* Ritz, being published by Frey Gessner.

A gynandromorphic specimen of *Megachile willughbiella* Kirby was described by Stenton in 1909. This was a partial lateral gynandromorph, the right side being female, the left side male, with the genital armature of the normal male structure. He states that "the colour of the hairs of the dilated metatarsi on the male side are more golden than usual, and the outer margin of the joint is black, otherwise either side retains the usual outward characters of its respective sex." This specimen therefore seems to be a true gynandromorph, with its contrasting male and female regions, each region definite as to sex.

The next reference to an abnormality of sex in the genus was made by Cockerell (1911) when he proposed the new genus *Androgynella.* He found a series of fourteen females of an Australian species which he had previously described from the male as a *Megachile,* but found that in the females the antennae were thirteen-jointed, this being a normal male character, while normal females have twelve-jointed antennae. In addition, the ventral surface of the abdomen in these females was smooth and bare, with no trace of the scopa or pollen-brush characteristic of the genus. This implied a parasitic habit, since the means of stocking its own nest was lacking. Later (1918) he recorded two specimens of the same general character from the Philippines. In these the head and thorax were more or less male, with the abdomen female, and they were apparently derived from a species of *Megachile* of that region that he had previously described. He thus gave them the same specific name, but assigned them to *Androgynella* (*A. subrixator* Ckll.), at the same time expressing the opinion that they were possibly only *Megachile* gynandromorphs. One of these had 13-jointed antennae, with the head and thorax apparently identical with the male of *M. subrixator,* but in the other specimen the antennae were somewhat shorter and only 12-jointed. Thus it seems very doubtful that these latter are normal forms, but are rather in the nature of intersexes, both specimens being females in which the male characters have been caused to appear, and one being slightly less modified than the other.

Sexual Dimorphism in Megachile

In order to fully appreciate the unusual character of the forms herein described, some discussion of the contrasting characters of the males and females of *Megachile* is necessary. Since the female seems to be the more stable form, with fewer variable secondary sex characters, it will be described first (Pls. XXXI and XXXIV, figs. 1 and 2).

The antennae in the female *Megachile*, in common with the other bees and wasps, have twelve joints, the terminal one normally being somewhat longer than the others, but not appreciably dilated or expanded. The face and clypeus may be quite densely pubescent at the sides, along the inner margins of the eyes, but the median portion below the antennae and on the clypeus is usually rather thinly pubescent, at least as compared to the male. Clypeal protuberances are not the rule, but are present in a few species. The mandibles are usually robust, expanded apically, the cutting edge with from three to five more or less acute denticulations, while the inferior margin is as a rule straight and simple, usually with a marginal row of rather stiff hairs or setae. In a few cases there are basal prominences on the mandibles, either above or below.

The thorax is usually quite densely pubescent at the sides and below, but more thinly so above. The legs are simple, without conspicuous spines, protuberances or scales. Each of the front and middle tibiae has a single apical spur, and the hind tibia has two such spurs. The first or basal joint of all the tarsi (metatarsi) is longer than any of the other tarsal joints, usually about as long as the other four combined (Pl. XXXI). Those of the front legs are usually narrow and more or less cylindrical, those of the middle legs being broader and flattened, while those of the hind legs are more often very broad and strongly flattened, longer than the other metatarsi, and frequently as long as the hind tibiae. The claws are simple, but some times with a basal tooth or seta.

The abdomen has six dorsal and six ventral segments, those in the central part of that region usually being slightly broader than the basal segment, while the segments toward the apex become much narrower. In some of the species, however, the

abdomen is more or less parallel-sided, and the segments consequently are of about the same width except the apical one, which in this group is vertical in position. The ventral segments, with the exception of the first, have a dense brush of long stiff hairs which forms the scopa or pollen-collecting apparatus. This is about equally dense on all the segments except the apical one where it is often reduced to a mere fringe around the edge of this small ventral plate. The sting and accessory plates are located inside the abdomen near the apex, and the sting is exserted when in use through the terminal opening between the dorsal and ventral plates of segment six.

In most of the species of *Megachile* the male is strikingly different in appearance from the female (Pl. XXXIV, fig. 1). Even in the more generalized forms, which lack the conspicuous spines, scales and protuberances found in many of the species, the appearance is quite different. The antennae are 13-jointed, as in the other bees and wasps, the apical joint in some of the forms being not only longer than the others, but also being much flattened and more or less broadly dilated. In some cases the width of this terminal joint is equal to its length. The face and clypeus are usually densely covered with long silky pubescence, entirely hiding the surface and extending down over and hiding the apical margin of the clypeus. Beneath this dense pubescence the punctures are much finer and closer than in the more thinly pubescent females, where the punctures are more coarse and sparse. The cutting edge of the mandible is not so broadly expanded as in the female, and usually bears three rather large triangularly pointed teeth. The inferior margin of the mandible in most of the species bears a more or less conspicuous projection. This is often located near the base, but in some species is near the center or toward the tip. The shape of this projection is various, but is more often triangular and pointed below. Beneath this inferior mandibular projection, on the lower angle of the cheeks, there is often a concave polished non-pubescent area, and in some instances the lower margin of this area is drawn out into a plate or spine.

On the male thorax the pubescence is usually longer and more dense than in the corresponding female thorax, and the punctures

are also finer and closer. In the more generalized species the legs appear somewhat similar to those in the female, but the metatarsi are usually narrower, the hind metatarsi being shorter and but slightly broadened and flattened. The claws are strongly cleft, the outer part of the consequently double claw being usually somewhat longer than the inner part. Each front coxa usually bears a spine or projection which may be largely hidden by the pubescence, or, as in some cases, may be reduced to dentiform angles or may be entirely absent.

In the more highly specialized forms, not only do the above characters hold, but the front legs especially are often highly modified and brightly colored. The front coxae are more often bare, exposing the coxal spines, and a small patch of ferruginous bristles or setae is usually located on the coxa near the base of the spine. The front metatarsi are often broadly dilated (Pl. XXXI), the anterior margin being expanded and hollowed out into a large scale in many species. The second and third tarsal members may also be rather widely dilated, but are usually much shorter than the metatarsi. These highly modified tarsi are usually brightly colored, either ferruginous, testaceous, or ivory, and have a dense and rather long hair-fringe along the posterior margin. In a few instances the entire front leg is more or less ferruginous or testaceous, contrasting with the dark middle and hind legs. The middle legs are usually much less modified than the front ones, but in some species the usual tibial spur is replaced by an apical projection or spine of the tibia itself, and the metatarsi in a very few instances are provided with protuberances or spines. The hind legs are usually even less modified than the middle ones, but the metatarsi are distinct from those in the female in being very much shorter and convex on the outer surface, rather than flat or slightly concave as in the female. Spines are sometimes found not only on the front coxae but also on the middle pair, and on the mesosternum in addition.

There are six plainly evident dorsal segments in the abdomen of the male, but only four ventral segments, or as in some species, only three (Pl. XXXIV). The apical three or four ventral plates have become hidden due to the telescoping of the

abdomen, and lie closely associated just above the fourth (or third) ventral plate, inside the abdomen. The sixth dorsal segment usually has a transverse carina which divides it into dorsal and ventral surfaces, this carina forming the actual apex of the abdomen. The morphological apical margin of this segment is therefore ventral in position. A small inconspicuous seventh dorsal segment is usually evident, this of course also being ventral in position, and it forms the morphological apex of the abdomen. The genital armature is located inside the abdomen, closely associated with the telescoped ventral plates and surrounded by the entirely hidden eighth segment. The armature is exserted through the ventral opening between the seventh dorsal and fourth (or third) ventral plates during copulation. The exposed ventral plates may be somewhat pubescent, but the pubescence is usually thin and short as compared to the female abdomen, entirely distinct from the scopa.

Descriptions

Most of the material described here is from the general region of Corumba, Chapada and Pedra Brancha, Brazil, found in the H. H. Smith collection. The first five of the specimens, however, are from North America, and from widely scattered localities, one from North Carolina, one from Kansas, one from Oregon, and two from Alberta. There is also one anomalous specimen from Paraguay, and several normal specimens from Paraguay and Bolivia, which are of importance at least in indicating the range of some of the species concerned.

Several of the anomalous forms from South America could not be referred to described species, but in most instances they were at least referable to apparently normal forms of undescribed species. Where such normal forms were found, they will be described first and will constitute the types of the respective species. This seems preferable to describing the abnormal forms, even though this paper is not concerned primarily with taxonomy, for otherwise these anomalous specimens would become the types. These descriptions, therefore, will precede the description of the anomalous form in each instance.

Megachile vidua Smith, Intersex 1 (Pl. XXXIV, fig. 3)

The head except for the antennae, is like that of a normal male, but the antennae have but twelve joints. The terminal joint of the right antenna is modified (Pl. XXXII), being dilated and thickened apically, with the upper apical half obliquely truncated and shining, but with no indication of a division into two joints. The terminal joint of the left antennae is not obliquely truncated, but has the upper surface polished, and on the outer margin there is a slight indication of a division into two joints.

The thorax, including the legs, is male in character, the front tarsi being dilated and colored as in the male, the front coxae definitely spined, and the claws cleft, no difference from the normal male condition being noticeable.

The abdomen exhibits an intergradation between the male and female, with the apical margins more strongly depressed than in the female, with the pubescence of the first two segments pale, and with a conspicuous white apical fascia on the fourth segment, but none on the fifth. In the normal female, the fifth segment has a fascia which is fully as conspicuous as that on the fourth. The sixth segment, however, is similar to that in the female, and there are six ventral segments which are shining and devoid of pubescence or of evident puncturation. The sting is not exserted.

This specimen, therefore, exhibits maleness in the head, thorax, and dorsal abdominal segments as far as the fifth, and femaleness in the sixth dorsal segment and in all the ventral segments of the abdomen, while the antennae are intermediate between the two sexes and cannot be definitely assigned to either one.

This was captured at Bilby, Alberta, Canada, on June 24, 1924, by Dr. George Salt.

Megachile vidua Smith, Intersex 2 (Pl. XXXIV, fig. 4)

This specimen has a male head and thorax, but here again the antennae are different. The right antenna is 13-jointed and apparently entirely male in character, but the left one has only twelve joints, the apical one being modified, dilated and thickened apically, with a slight indication of a division into two joints on the inner margin (Pl. XXXII).

The abdomen exhibits more femaleness than that in the preceding specimen, as the segments are less depressed on the apical

margins, and both segments four and five have conspicuous white apical fasciae. Segment six is female in character, and the six ventral plates are shining, impunctate and nonpubescent as in the other specimen. The sting is not evident externally.

This specimen is slightly more male in the antennal characters, therefore, but more female in the abdominal characters than the first one. It was captured at Lethbridge, Alberta, on July 28, 1923, by Mr. H. E. Gray, and was found in a collection belonging to Mr. Owen Bryant.

Megachile parallela Smith (*M. sexdentata* Robertson) (Pl. XXXV, fig. 2)

Except for the antennae, the head and thorax in this specimen are entirely male in character, but the antennae show an intergrading condition between the sexes. They are both 12-jointed, but the terminal joint in each has a line of division in the center of the outer margin which extends for about half the distance across the joint (Pl. XXXII). Thus, viewed from the outer side, each antenna appears as though 13-jointed, but from the inner side only 12-jointed. The apex of the right antenna is slightly misshapen, being bent toward the inner margin.

The abdomen also is intergrading between the sexes. The dorsal surfaces of segments one to five are more deeply depressed on the apical margin than in the female, but less so than in the male. The sixth dorsal segment is female in character. There are six ventral segments as in the female, but they are punctured and pubescent about as in the male, the normal female of course having a dense scopa and being more closely punctate, while the male has rather long but thin white pubescence and with the punctures more widely spaced. A sting is projecting out between the terminal dorsal and ventral plates.

This specimen was found in the collection of the University of Kansas and bears the following data: Lane Co., Kansas, 2760 feet, F. X. Williams.

Megachile gemula Cresson (Pl. XXXV, fig. 1)

This specimen appears as a normal male except for the terminal abdominal segments. The antennae are definitely 13-jointed, and all the other characters of the head and thorax are typically male. Also the first four segments of the abdomen

seem to be as in the normal male, the puncturation and pubesence being quite similar, the segments having traces of apical white pubescent fasciae at the sides as in many of the males of this species, and the ventral plates are bare and flattened, similar to those that are exposed in the male. But the fifth and sixth ventral plates are exposed, as in the female, and are quite densely covered with golden-brownish pubescence, this being quite long on segment five, but short on segment six. The dorsal plates of these two segments are of course more female than male, the sixth being definitely female, while the fifth partakes of the nature of the male in having a trace of an apical white pubescent fascia. A sting is clearly evident. In the female of this species the abdominal fascia are lacking, and the scopa is usually deep black.

It is very interesting to note, regarding the psychological reactions of such abnormal individuals, that this specimen was attempting to copulate with a female at the time of capture, in spite of the fact that it was supplied with a sting in place of the male genital armature. It was captured by Mr. J. C. Crawford at Bryson City, North Carolina, on June 17, 1923.

Megachile perihirta Cockerell (Pl. XXXV, fig. 3)

In this specimen the face is pubescent as in the male, and the mandibles are definitely male, but the antennae are 12-jointed, with no indication of a division of the terminal joints. The legs show a curious mixture of sex characters. The front coxae are thinly pubescent in front and have spines that are about half the normal length. The front femora are colored about as in the normal male, but the tibiae seem to be more female in character, being entirely dark. The basal half of the front metatarsus is ivory-colored and dilated as in the male, but the joint narrows to the tip and the apical half is dark, as also the other tarsal joints, just as in the female (Pl. XXXIII). The middle femora are swollen, but not so strongly so as in the male, and the mid metatarsi appear much as in the male on the outer surface, but the keel-like protuberance beneath is much weaker than in the normal male. The hind legs are largely female in character, with rather slender femora and broad flat metatarsi. The mesonotum is finely punctate and has long and rather dense pubescence, suggestive of the male.

The dorsal segments of the abdomen are more male in character, with entirely pale and rather long pubescence, this being shorter and mixed with black in the female. The apical dorsal plate is more definitely female, and there are five well developed ventral plates, these being largely bare and with only scattered punctures and a few rather long hairs. The sixth ventral plate is not completely developed, but consists of two lateral plates with an intervening space, the plate on the left reaching nearly to the tip of the dorsal plate, but that on the right extending for only about half this distance. A well developed sting projects outward between these two plates.

This specimen was collected by Professor H. A. Scullen, and bears the following data: Cloud Cap Inn, Coopers Spur, Mt. Hood, Oregon, elevation 6000 ft., August 19, 1927.

Megachile bertoni Schrottky (Pl. XXXVII, fig. 3)

Two very similar specimens of this species were found. The head and thorax are male, although somewhat larger than in the normal males, the antennae 13-jointed, the clypeus densely bearded apically, and the claws deeply cleft, just as in the typical male. The abdomen is female, but with the venter bare of pubescence except for some short pale hairs on the sixth segment, the dorsal segments punctured as in the female, but the ochraceous pubescence of the apical segments less conspicuous than in a fresh normal female. This is due at least in part to the rubbed condition of the specimens. The antennae are broken in one of the specimens, but are both intact in the other.

Both specimens are from Chapada, Brazil (coll. H. H. Smith), and the same lot of material contained twenty-eight normal females and fifteen normal males from the same locality, and dated from September to January and March.

Megachile tapytensis new species (Pl. XXXVI, fig. 3)

Male with mandibles 3-dentate, without an inferior projection; apical joint of antenna not dilated; anterior coxae with short triangularly pointed spines; anterior tarsi dilated to the width of their tibiae, not hollowed out in front, the second joint whitish, but the metatarsus and three apical joints ferruginous, the second joint but slightly shorter than the first, and these two together about as long as the tibia (Pl. XXXII); transverse carina of apical abdominal segment emarginate medially, entire at the sides.

Male.—Head broad, eyes slightly converging below, face and clypeus densely covered with cream-colored pubescence, anterior margin of clypeus with a small median emargination; mandibles black, with a dense fringe of pale ochraceous pubescence at base below and a few erect dark hairs on outer face near base; cheeks fully as broad as eyes, closely and finely punctate, with thin and short ochraceous pubescence, but that below dense and white; vertex slightly rounded, slightly concave on hind border, closely and finely punctate, with long erect ochraceous pubescence; lateral ocelli subequally distant from eyes and edge of vertex; antennae long and simple, the basal joint of the flagel about equal to the pedicel in length, the second and following joints about twice this length, ferruginous beneath, fuscous above.

Mesonotum and scutellum with fine densely crowded punctures, those on the pleura also crowded but somewhat coarser, those at the sides of the propodeum minute and rather close; pubescence ochraceous on mesonotum and scutellum, paler on propodeum and upper pleura, becoming white below; tegulae pale ferruginous, minutely punctate; wings pale fuliginous, more deeply so in region of radial cell, the nervures brownish-testaceous, recurrent nervures about equally distant from base and apex of second submarginal cell.

Legs largely red, their pubescence yellowish or white; anterior coxae with considerable white pubescence anteriorly, denser and longer behind; anterior trochanters simple, red, white-fringed behind, the femora hardly keeled at apex below, entirely ferruginous, with dense white pubescence on basal two-thirds of posterior face, the tibiae entirely ferruginous except for the slightly darkened posterior margin of the outer face; second joint of front tarsi with a large black spot beneath, posterior fringe brown beneath, white above, but the white obscured by the color beneath; middle legs ferruginous except the darkened hind margin of the outer face of the tibia and metatarsus, and the femur slightly darkened at apex beneath, the tibia with the usual spur and without teeth or spines, the second and third joints of the tarsi together about as long as the first joint, the tarsi with a long thin ochraceous posterior fringe; hind legs ferruginous, but the tibiae and tarsi somewhat darker (the left hind tibia almost fuscous), the tarsi narrow, the metatarsi in front and behind with long thin ochraceous fringes; spurs pale ferruginous; claws deeply cleft, with strong basal spines or setae.

Abdomen parallel-sided, the first segment with dense ochraceous pubescence, that on segment two blackish toward apex, and segments three to five with discs black pubescent, segments

one to four with entire pale ochraceous apical fasciae which are not at all narrowed medially, segments four and five also with basal fasciae of the same color, segment five with a slight indication of an apical fascia on each extreme side; basal segment closely and finely punctate, becoming more sparsely so apically, but segment six finely rugoso-punctate, with scattered erect dark hairs and a very fine inconspicuous pale pilosity, the disc vertical in position, protuberant in the center above, the morphological apex of the segment with a low carina on either side of the middle but with no evident lateral teeth; surface below the transverse carina with rather numerous long black hairs; segment seven barely visible; four ventral segments visible, these black, punctate, thinly pale pubescent, white fringed apically. Length, 10 mm.; breadth of abdomen, 3.5 mm.; length of anterior wing, 7 mm.

Type: Male; Tapyta, Paraguay, Nov. 25.

Paratypes: one male, topotypical; one anomalous specimen, Villarrica, Paraguay, 1 [January ?], 1923.

In the characters of the head and thorax, the anomalous specimen (Pl. XXXVI, fig. 4) is identical with the type described above, except that the front femora are ferruginous on the outer faces, and the hind tibiae and tarsi are not at all darkened. The abdomen is essentially female, but segments one to five of the venter are devoid of pubescence, shining and impunctate, the integument of segment five being narrowly ferruginous apically, and ventral segment six with considerable pale pubescence which is short and dense at the apex. The dorsal plate of segment six exhibits a tendency toward maleness, being finely rugoso-punctate, finely pale pruinose, with erect darker hairs, and with a slight indication of a protuberance near the center of the base which is suggestive of the male. The pubescence and puncturation are otherwise as in the male, except that the basal fasciae of segments four and five are lacking, and segment five has a distinct apical fascia.

This may possibly be *Megachile fossoris* Smith, as females from the same localities, which bear some resemblance to these males, so far as color of pubescence is concerned, run to that species in Schrottky's key (1913), and fit the description fairly well. These three specimens were found in a collection belonging to Dr. Reinhold Meyer, of Darmstadt, Germany.

Megachile sp. (Pl. XXXVII, fig. 4)

Unfortunately this specimen could not be referred to any species, described or new, and it is therefore described here in considerable detail. With the discovery of the normal male, if the species proves to be undescribed, a redescription, at least of the abdominal characters, will be necessary. The head and thorax are male in character and are quite likely identical with those regions in the normal male, but the abdomen is essentially female.

Head broad, eyes slightly converging below, front and clypeus with dense cream-colored pubescence, that on the upper part of the clypeus erect and the surface therefore visible, this closely and deeply punctate; mandibles 4-dentate, the two middle teeth small, with no inferior projection, but rather densely white-fringed on the lower margin basally; cheeks narrower than eyes, with dense white pubescence, long below, short above, very finely and closely punctate, the posterior margins not carinate; vertex slightly rounded, finely and quite densely punctate, with thin obscure brownish pubescence; lateral ocelli slightly nearer edge of vertex than to eyes; antennae dark, obscurely reddish below, basal joint of the flagel about equal in length to the pedicel, only half as long as the second joint, the succeeding joints about equal in length to the second one (the apical one missing, making it impossible to say whether there are twelve or thirteen joints).

Mesonotum dull, the punctures fine but distinctly separated toward the sides and front, extremely fine and densely crowded posteriorly, as also on the scutellum, punctures of pleura relatively coarse and distinctly separated, lateral faces of propodeum shining, with minute punctures; pubescence on disc of mesonotum short thin and fuscous, on scutellum long and fuscous, white on pleura and sternum, the posterior margin of the pronotum with a dense line of cream-colored pubescence, and a tuft of the same color just behind and above each tegula, a definite line of white pubescence across the metanotum (below the scutellum) and a dense white tuft around the tubercles and behind the wings; tegulae yellowish-ferruginous, minutely punctate; wings pale fuliginous and somewhat violaceous, the radial cell and adjacent parts dark fuliginous, nervures fuscous, recurrent nervures about equally distant from base and apex of second submarginal cell; legs dark red or fuscous, white pubescent, the tarsi ferruginous, front coxae with short acute dentiform spines, white pubescent, anterior tarsi entirely simple and without a posterior fringe (Pl. XXXII), middle tibiae with

the usual spur, hind metatarsi slender; spurs testaceous; claws cleft.

Abdomen with punctures indistinct and rather close basally, becoming somewhat more distinct and sparse apically; basal segment with entirely pale pubescence, segments two to six with black pubescence on discs, segments one to four with lateral apical patches of white pubescence, and segment five with an entire white apical fascia; segment six triangular in outline, with the sides straight or very slightly concave as viewed from above, straight in profile, with appressed pale pubescence apically, the disc with numerous erect black hairs; venter with six exposed segments which are bare and polished, with a few scattered punctures, dark red in color, with the apical margins coppery; ventral segment six with some short pubescence at extreme tip; tip of sting visible between the dorsal and ventral plates of the apical segment. Length, 9 mm.; breadth of abdomen, 3 mm.; length of anterior wing, 7 mm.

Chapada, Brazil, January (coll. H. H. Smith), [Ac. Nat. Sci., Phila.].

Megachile intergradus new species.

The series of specimens that are described under this name contains both normal and anomalous females, the latter varying in degree of the abnormal condition. The normal series will be described first, as the type is naturally selected from this group.

Female with apical margin of clypeus broadly and evenly incurved, mandibles 4-dentate; scutellum flat above; abdomen broad and flat, segment six straight at sides and in profile; scutellum polished and indistinctly punctate; abdominal segments one to five with pale ochraceous apical fasciae; scopa orange, fading to white basally, without any apical black hairs.

Female.—Head broad, eyes subparallel, apical margin of clypeus entire but broadly and evenly incurved, cheeks narrower than eyes, vertex flat, the lateral ocelli slightly nearer edge of vertex than to nearest eyes, basal joints of flagel subequal in length, longer than the pedicel; posterior margin of scutellum somewhat elevated and obscurely triangular; all of the metatarsi definitely shorter than their tibiae, but considerably longer than the other tarsal joints combined, the middle and hind metatarsi fully as broad as their tibiae, the outer surface of the hind tibia flat, claws with sharp setalike basal teeth, otherwise simple (Pl. XXXIII).

Punctures of clypeus and supraclypeal area sparse but dis-

tinct, a median longitudinal area impunctate, surface shining between the punctures; punctures close and fine on cheeks, very sparse on vertex laterally, finer and closer behind ocelli, very fine and close on face below anterior ocellus; mesonotum polished posteriorly, doubly punctate, having rather numerous minute punctures and scattered larger ones, the punctures close anteriorly where the surface is dull; punctures of pleura close and fine above, sparser below; surface of propodeum velvety, finely and closely punctate; discs of abdominal segments very sparsely punctate before the fasciae, becoming rather fine and close on each segment basally and also beneath the fasciae, seen where the pubescence is rubbed.

Color black, the mandibles obscurely reddish toward the apex, the flagellum dull ferruginous beneath, the tegulae yellowish-ferruginous, anterior wings pale fuliginous, somewhat darker along the costal half of the radial cell, the nervures brown; legs ferruginous, fuscous on posterior face of anterior femora; spurs testaceous. Pubescence white on cheeks, pleura, propodeum, sternum, and on legs at least in part, mixed fuscous and white around the antennae and on the inner orbits, with short thin fuscous hairs on vertex, mesonotum, and scutellum, a dense tuft of fuscous pubescence on each pronotal tubercle which is also fringed behind with equally dense contrasting white pubescence, and a large spot of fuscous pubescence on mesopleura beneath each tegula; clypeus, mesonotum and scutellum largely bare; basal segment of abdomen with dense pale ochraceous pubescence at sides and with an entire relatively narrow apical fascia of the same color, segments two to five with entire apical fasciae which are about twice as broad as that on the basal segment and of the same color, these segments also with extremely short inconspicuous black pubescence on the discs; segment six with appressed ochraceous pubescence and erect black hairs. Length, 14 mm.; breadth of abdomen, 5.25 mm.; length of anterior wing, 10.5 mm.

Type: Female, Corumba, Brazil, April, (H. H. Smith). [No. 4107, Academy of Natural Sciences of Philadelphia].

Paratypes: Six females, Chapada, Brazil, September, November, January and March [Academy of Natural Sciences of Philadelphia]. Four females (with legs, especially femora and tibiae, blackish), Beunavista, Bolivia, altitude 450 m. (Dr. Reinhold Meyer). Seven anomalous females, from Chapada and Pedra Brancha, Brazil, [Academy of Natural Sciences of Philadelphia].

This species runs to *Megachile friesei* Schrottky in Schrottky's key (1913), but differs from the description of that species as follows: Head greyish pubescent, mixed with fuscous around the antennae, with clypeus largely bare; scutellum with entirely blackish or fuscous pubescence; scopa fulvous, yellowish basally; length 14 mm., breadth 5 mm. As described, *M. friesei* has the pubescence of the head whitish, of the scutellum yellowish, with yellow scopa, and is larger (16 mm., breadth 6 mm.). Nothing whatever is given as to structure in the description.

The anomalous conditions observable in this series of specimens are of varying degrees, showing a slight or considerable change toward the male condition as the case may be. The series may be divided quite easily into three groups depending on the degree of change, and those specimens showing less change will be described first.

Sex intergrade 1. This differs from the normal female as follows: Clypeus and supraclypeal area very closely and finely punctate laterally, more sparsely so in the center where the surface is shining, but without a definite median impunctate area; cheeks broader, about as broad as the eyes, the white pubescence more dense below; vertex broader and more closely punctate, but still rather sparsely so laterally, the lateral ocelli about equally distant from eyes and edge of vertex; mesonotum finely and quite closely punctate throughout, somewhat shining posteriorly, with short mixed fuscous and greyish pubescence; scutellum shining, but with rather fine close punctures and with rather long fuscous pubescence; front trochanters normal; front coxae each with a slight carinate area in the region where the spine is located when present in the normal male; all the metatarsi shorter than in the normal female, the anterior ones obscurely whitish, about equal to joints two to four in length, these also being obscurely whitish; mid metatarsi hardly as broad as their tibiae, slightly shorter than joints two to five combined; hind metatarsi somewhat concave on outer face but much shorter and narrower than their tibiae, slightly longer than joints two to five combined; no long posterior fringes on either the front or middle tarsi; hind claws with their apices emarginated, subcleft, mid and front claws each with an inconspicuous median inner tooth or angle; abdominal segments in general more closely punctate, and with the black pubescence of the discs more in evidence; scopa well developed but paler in color; otherwise, including the antennae and mandibles, the characters are similar to those in the normal female.

One specimen, from Pedra Brancha, is all that is included in this group. It differs from the normal female principally in the puncturation, color of pubescence, shape of the metatarsi, and the slight change of the claws toward the male condition.

Sex intergrade 2. This group which contains four specimens, shows the following changes or advance toward maleness over *intergrade 1*: The clypeal margin is more strongly incurved, with a slight median denticle, its apical half and the supraclypeal area yet more finely and closely punctate; the subappressed greyish pubescence of the mesonotum is much more dense, nearly hiding the surface, and is much more conspicuous than the short erect fuscous hairs; the scutellum, however, is polished, with mostly longer erect fuscous pubescence; front trochanters pointed at the apex below; anterior metatarsi very short and thick, being but slightly longer than wide, whitish-hyaline on the outer face, and the other joints pale yellowish, joints two and three together distinctly longer than the metatarsus, pubescence beneath brownish, in front and behind silvery white, hardly as long as the width of the joints but tending toward a fringed condition; mid metatarsi shorter than joints two to five combined, with a short posterior white fringe; hind metatarsi about equal in length to joints two to five, the outer face more convex than in *intergrade 1;* hind claws distinctly cleft, and the front and middle ones with distinct inner median teeth, the basal teeth reduced to setae; abdominal segments yet more closely and finely punctate; scopa well developed, orange apically, white basally; sting and female genitalia apparently normal; antennae with twelve joints; mandibles as in the normal female.

Three of the specimens in this group are from Pedra Brancha (April) and the fourth from Chapada (October). The principal advance in maleness over specimen of *intergrade 1* is seen in the modification of the front tarsi, in the more definitely cleft claws, and in the generally finer puncturation.

Sex intergrade 3. The two specimens in this last group show the following advances toward maleness over group 2: Supraclypeal area uniformly very closely and finely punctate, apical half of the clypeus very minutely and closely punctate, with pubescence more dense but not quite hiding the surface, the punctures on the upper half relatively coarse and sparse; cheeks with a definite area below where the white pubescence is long and

dense; antennae definitely 13-jointed, the basal joint of the flagellum considerably shorter than joint two, the others increasing in length to the apical one, which is neither dilated nor flattened; lower apical angle of trochanters more produced, almost spine-like; front metatarsi whitish-hyaline, about as broad as long, very thick, the anterior hair-fringe becoming quite long, some of the hairs being longer than the width of the metatarsi, the posterior fringe hardly as long, joint two more narrow, but fully as long as the metatarsus (Pl. XXXIII); mid metatarsi about equal to joints two to four in length, with a quite distinct but rather short white fringe behind; hind metatarsi quite strongly convex, slightly shorter than joints two to five; claws much as in group 2, but rather variable as to their cleft condition (Pl. XXXIII); abdomen not much different from group 2, the scopa being fully as well developed and no difference in the apical segment from the normal female condition is noticeable.

The more conspicuous changes shown by the anomalous individuals of this series are included in the following table:

	Puncturation	Pubescence	Cheeks	Metatarsi	Claws	Antennae
Normal ♀	Punctures sparse on clypeus, on vertex laterally, mesonotum posteriorly, and on abdomen before the fasciae; mesonotum polished posteriorly.	Clypeus mesonotum and scutellum largely bare.	Narrower than eyes, the lower angle with thin white pubescence.	Longer than other tarsal joints combined; as broad as tibia on mid and hind legs, concave on outer face.	Not at all cleft, but with sharp basal teeth.	12-jointed
Sex intergrade No. 1	Punctures close and fine on clypeus laterally; closer on vertex medially; fine and close on mesonotum throughout.	Mixed grayish and fuscous on mesonotum; rather long fuscous on scutellum; dense on clypeus apically.	About as broad as eyes, pubescence on lower angle more dense.	Shorter than other joints combined; front ones obscurely whitish, mid and hind ones concave on outer face.	Subcleft.	12-jointed
Sex intergrade No. 2	Clypeus, mesonotum and abdomen more closely and finely punctate.	Grayish pubescence on mesonotum more dense, nearly hiding surface.	As broad as eyes below, white pubescence is very dense.	Front ones short and thick, whitish hyaline, shorter than joints 2+3; outer face on hind leg convex.	Distinctly cleft, basal teeth reduced to setae.	12-jointed
Sex intergrade No. 3	Clypeus and supraclypeal area very closely and minutely punctate; mesonotum closely and finely punctate.	Pubescence more dense on clypeus.	With dense white pubescence below.	Front ones whitish-hyaline, breadth equal to length, and very thick, anterior hair-fringe long; hind metatarsi strongly convex.	Cleft.	13-jointed

One of the specimens of the third group is from Pedra Brancha (April) and the other from Chapada (September). The 13-jointed antennae and the further modification of the tarsi and front trochanters show an advance over the condition seen in group 2. The tendency of the front trochanters toward a spined condition, and the relatively long anterior hair-fringe of the front metatarsus suggest the possibility that this species is the same as *Megachile hilarimorpha* Strand, described only from the male, which has spined anterior trochanters and extremely long anterior hair-fringes on the front metatarsi.

Megachile dilatata new species (Pl. XXXV, fig. 4)

This form is fully as interesting and puzzling as any of the others described here. There are five specimens in the series, all of them nearly indentical as to structure, except that one of the specimens has the antennae 12-jointed, whereas the antennae in the other four are definitely 13-jointed. The head and thorax are strongly male in character, as shown by the densely pubescent face, the modified and colored tarsi and other leg joints, the cleft claws, and above all by the extremely widely dilated apical antennal joints, these being fully twice as long and twice as broad as any of the preceding joints (Pl. XXXII). The dorsal abdominal segments are possibly somewhat male in character, but this is difficult to show without a normal male or female for comparison. Otherwise the abdomen is female, with six ventral plates, a well developed scopa, and a sting.

Mandibles 4-dentate, without an inferior projection; joint twelve of antenna dilated apically and flattened, joint thirteen dilated to about twice the width of joint twelve and obliquely pointed at apex; all the tarsi yellow, the metatarsi narrowly margined behind with black (Pl. XXXII); front coxae without definite spines; front metatarsi shorter and narrower than their tibiae, parallel-sided, longer than joints two to five combined, with a thin white posterior hair-fringe; abdomen female in character, with a white scopa; segment five slightly concave at sides, nearly straight in profile.

Gynandromorphic female. Head broad, eyes subparallel, face densely covered with pale ochraceous pubescence; clypeus closely and finely punctate, the apical margin beneath the beard

deeply emarginate medially; mandibles shining, obscurely reddish toward apex, with a few striate punctures in center above, closely and finely punctate at base on outer face, lower margin entire; cheeks below as broad as eyes, somewhat narrower above, closely and finely punctate, densely white pubescent below, becoming thinner, shorter and pale ochraceous above; vertex flat, the hind margin slightly concave, closely and finely punctate, with rather thin reddish-ochraceous pubescence; lateral ocelli nearer each other than to eyes, and slightly nearer the eyes than to edge of vertex; antennae 13-jointed, joint one of flagellum slightly longer than joint two, joint thirteen as long as the two preceding joints combined, dilated to about twice the width of joint twelve, obliquely pointed at apex.

Thorax above with rather dense reddish-ochraceous pubescence, with two anterior oblique indistinct spots of appressed tomentum of the same color, and a similar band in the scutello-mesothoracic suture, pubescence at sides and beneath white, becoming pale ochraceous above and behind, a dense tuft around each tubercle of the pronotum and another just above and behind each tegula; mesonotum and scutellum very densely and finely punctate, the punctures of the pleura crowded but somewhat coarser, on propodeum minute and well separated; tegulae ferruginous, minutely and rather closely punctate; wings subhyaline, more distinctly clouded apically, nervures fuscous to ferruginous, the first recurrent nervure distant from base, the second much nearer apex of the second submarginal cell.

Coxae and trochanters black, white pubescent, anterior femora not strongly keeled beneath, polished ferruginous above, black on basal third of posterior face, ferruginous on apical two-thirds, this face minutely punctate and white pubescent, the antero-inferior face black basally on upper margin, otherwise polished and reddish-testaceous; anterior face of front tibiae fuscous, the other two faces ferruginous; front tarsi pale yellow, the metatarsi with fuscous setae in front, the white posterior hair-fringe about as long as the joint is wide; mid femora black except the apical third which is ferruginous, not much swollen; mid tibiae largely ferruginous, rather strongly angulate at apex beneath, but with the usual spur; mid metatarsi slightly narrower than those of the front legs, about equal in length to joints two to five combined; hind femora black, rather slender; outer face of hind tibia fuscous on anterior or lower margin, ferruginous on the opposite margin; hind metatarsi about as broad as their tibiae, parallel-sided, subconvex on outer face, about twice as long as broad and about as long as joints

two to five combined; spurs testaceous; claws cleft, without basal teeth, blackish apically.

Abdomen with a definite entirely white scopa and a well developed sting and female genitalia; dorsal segments closely and finely punctate basally, the punctures becoming somewhat coarser and more definitely separated on segment five; pubescence reddish-ochraceous, without any black hairs, long and dense on segment one, becoming thin and shorter apically, segments one to five with entire pale ochraceous apical fasciae, and segment five with basal two-thirds covered with pale ochraceous tomentum; segment six entirely covered with fine appressed pale tomentum and with numerous erect pale hairs; apical ventral segment with a free apical lip which projects slightly beyond the scopa. Length, 12-13 mm.; breadth of abdomen, 4 mm.; length of anterior wing, 8 mm.

Type: Gynandromorphic female; Corumba, Brazil, April. [No. 4108, Academy of Natural Sciences of Philadelphia].

Paratypes: Three similar specimens and one specimen having 12-jointed antennae, all topotypical.

Megachile chapadiana new species (Pl. XXXVI, fig. 1)

The series of specimens included under this name contains several males from two separate localities and a single female, the latter unfortunately in bad condition because of the activities of museum pests. In the males the ventral abdominal plates are clothed with long dense pubescence which is practically identical with the scopa in the female, while in the female many male characters are evident. Thus there seems to be a tendency toward an approximation of the two sexes, since in the males in at least one character there is a tendency toward femaleness, and in the females a tendency toward maleness. The parts showing maleness in the females are not identical with the corresponding parts in the male, as we have seen in some of the other forms described, but they are definitely male in character nevertheless. The fact that the males in this series were captured in different localities (Chapada, Brazil and Buenavista, Bolivia) indicates that they are typical and that the dense pubescence on the ventral abdominal plates is a constant character. But with only one female it is impossible to say whether it is a normal form of the species or an abnormal specimen.

Male with mandibles 4-dentate, with a basal inferior projection; front coxae with short flattened spines and with a patch of short red bristles in front of the spines; front tarsi yellow, the metatarsi dilated and hollowed out in front, narrower than their tibiae, the anterior apex produced over the second joint, the hollowed-out portion fringed with yellowish hairs on both margins, the posterior fringe white, blackish beneath; mid tibiae at apex beneath with a short sharp subapical tooth and a much longer slender obliquely truncated apical spine, without the usual spur (Pl. XXXII); carina of segment six roundly emarginated medially, entire laterally; ventral abdominal plates with exceedingly long and dense ochraceous pubescence.

Male.—Head broad, eyes slightly converging below; face and clypeus with dense ochraceous pubescence; clypeal margin beneath beard entire; lower margin of mandibles with a slight angle midway between the apex of the apical tooth and that of the projection; cheeks about as broad as eyes, closely and finely punctate, densely white puebscent below, becoming thin and ochraceous above; vertex flat, the posterior margin slightly concave, closely and finely punctate, the pubescence thin, long and erect in the center, very short and black above eyes; lateral ocelli slightly nearer eyes than to edge of vertex; antennae slender, including the apical joint, ferruginous below, fuscous above, scape and pedicel blackish.

Thorax rather densely ochraceous pubescent above, fading to white below, and legs with mostly pale pubescence, a faint line of pale tomentum in the scutello-mesothoracic suture; punctures of mesonotum, scutellum and pleura very fine and dense; tegulae dull ferruginous, minutely and closely punctate; wings subhyaline, somewhat more infuscated apically and on the costal half of the radial cell, nervures fuscous, the recurrent nervures about equally distant from base and apex of second submarginal cell.

Front coxae black, white pubescent at sides and beneath, the spines rounded apically; front femora largely reddish-testaceous, strongly keeled apically, the posterior face with a sharp carina above the keel and running parallel to it, the space between the keel and the carina punctate and pubescent, piceous except the edge of the keel which is yellow, the lower edge of the femora toward the base strongly fringed behind with dense whitish pubescence; front tibiae piceous on outer face except apex, with mixed light and dark pubescence, otherwise polished ferruginous or testaceous; second joint of front

tarsi with a black spot beneath; middle and hind femora piceous to dark red, the tarsi yellow, but margined behind with fuscous; front and hind spurs testaceous, the front ones black at tip; claws cleft.

Segments one to four of abdomen closely and finely punctate, with rather long and dense, pale fulvous pubescence, a few black hairs at apex of segment four, segment five largely covered with appressed pale fulvous tomentum and with numerous erect long black hairs, segments one to five with apical fasciae of pale fulvous tomentum; segment six entirely covered with ochraceous pubescence, the carina quite prominent, morphological apex of segment with a low carina on either side of middle and a small tooth on each extreme side; segment seven inevident; four ventral plates exposed, these with exceedingly long and dense ochraceous pubescence which becomes short in apical middle and closely resembles the scopa of a normal female. Length, 11.5 mm.; breadth, 3.5 mm.; length of anterior wing, 8 mm.

Gynandromorphic female.—This specimen has been badly damaged by museum pests, and both eyes and most of both cheeks are gone and the apical antennal joints are missing (Pl. XXXVI, fig. 2). Head apparently broad and eyes slightly converging below; face and clypeus densely ochraceous pubescent, the anterior margin of the clypeus somewhat incurved medially; mandibles broadly expanded apically (as in most females), 4-dentate, the inferior margin entire; cheeks apparently about as broad as eyes, finely and closely punctate, whitish pubescent, densely so below; vertex flat, hind margin slightly concave, closely and finely punctate medially, more sparsely so laterally, with thin erect fuscous pubescence; lateral ocelli about equally distant from eyes and edge of vertex; antennae dark above, reddish below (number of joints not known).

Thorax ochraceous pubescent above and behind, paling to white below, very finely and densely punctate throughout except the impunctate triangular basal area of propodeum; tegulae dull ferruginous, minutely and quite closely punctate; wings subhyaline, faintly clouded apically, the nervures fuscous to brown; front coxae each with a definite, though short, sharp denticle, where the spine is usually found in normal males, and with a patch of reddish bristles in front of each one; front femora slightly keeled beneath at apex, but without the carina as found in the male, the posterior face fuscous and with rather long whitish pubescence, the upper face dark red and polished, the antero-inferior face reddish-testaceous along the middle, darker on the margins; outer face of front tibiae fus-

cous, punctate, and short yellowish pubescent, the other two faces polished and dark ferruginous; anterior tarsi yellow, hardly excavated in front, but slightly dilated, fringed in front with short yellowish pubescence, behind with the hair-fringe characteristic of the male, this brownish beneath, the second joint with a conspicuous black spot beneath (Pl. XXXII); middle and hind femora blackish, with pale ochraceous pubescence, the middle tibiae at apex beneath with the subapical tooth (though shorter than in the male) and the apical slender spine very similar to those in the male (Pl. XXXII), the mid tarsi yellowish, with a long thin pale hair-fringe behind; hind tarsi orange to reddish; front and hind spurs testaceous, the right front spur black at tip (as in the male), middle spurs lacking; all the claws cleft, but the inner teeth in each case shorter than the outer ones.

Pubescence and punctures of abdomen just as in the male, but the apical segment distinctly female, obtusely triangular with the sides straight viewed from above and straight in profile, the pubescence as in the male; ventral segments as in a normal female, but the scopa very similar to the ventral pubescence in the male, being long, dense and ochraceous, but becoming shorter in the apical middle. Length, 12 mm.; breadth, 4 mm.; length of anterior wing, 8 mm.

Type: Male; Chapada, Brazil, November, (H. H. Smith). [No. 4109, Academy of Sciences of Philadelphia].

Allotype: Gynandromorphic female, topotypical, October.

Paratypes: Two males, topotypical, September and October; two males, Buenavista, Dep. Sta. Cruz, Bolivia, altitude 450 m. These latter specimens differ somewhat in coloration from the type specimen, the pubescence being largely white on the head and thorax, with black hairs on the vertex, and some dark hairs intermixed on the mesonotum; the middle and hind femora and tibiae are deep black, and the "scopa" is almost white; structurally they are just as the type in all details.

Megachile uniformis new species (Pl. XXXVII, figs. 1 and 2)

This series contains nine males and one female. The female is almost exactly like the males in the secondary sexual characters, but of course the venter of the abdomen has six exposed plates. These ventral plates lack a scopa, but they are not bare and polished as in the other forms lacking a scopa that have been described here. Instead, they are punctate and pubescent,

with lateral apical fasciae on segments two to five, and their appearance does not suggest an abnormal condition.

Male with mandibles 4-dentate, with the lower margin entire; pronotum with a marginal band of dense yellowish-white pubescence; front coxae dark, without spines; front tarsi simple, without posterior fringes; abdomen conical, segment six above flat, obtusely triangular, the sides straight, the transverse carina slightly emarginate medially; four ventral plates visible, these entirely ferruginous. Female almost exactly like the male; segment six of abdomen with sides straight viewed from above and in profile.

Male.—Head broad, eyes slightly converging below; supraclypeal area, inner orbits and apical portion of clypeus densely ochraceous pubescent, the upper portion of the clypeus only thinly pubescent, with coarse punctures that are close laterally but well separated medially, apical margin of the clypeus beneath the beard slightly emarginate medially; inner tooth of mandibles large and strong, the apical one acute, the two middle ones smaller, lower margin fringed with long yellowish hairs; cheeks hardly as broad as eyes, closely and very finely punctate, with dense short white pubescence, longer below; vertex slightly rounded, very slightly concave on hind margin, punctures small but distinct and evenly distributed, pubescence very thin and dark brown; lateral ocelli about equally distant from eyes and edge of vertex; joint one of flagellum slightly shorter than the pedicel, the second and following joints being twice as long, the apical one simple.

Mesonotum, scutellum and pleura finely and rather closely punctate; pubescence of the mesonotum thin and ochraceous in front, shorter and dark brown over posterior two-thirds of disc, long and brown on scutellum, whitish on mesopleura and sternum, and with a whitish fringe between the posterior and lateral faces of the propodeum, and one between the propodeum and scutellum; tegulae yellowish-ferruginous, hardly punctate; wings slightly infuscated, the radial cell and adjacent parts strongly so, nervures brownish, the second recurrent nervure almost interstitial with the second cubital cross-vein, the first rather distant from the first cubital cross-vein; legs ferruginous, whitish or pale yellowish pubescent; front coxae with rather long thin white pubescence, and entirely lacking spines; mid and hind legs simple, slender, mid tibiae with the usual apical spur, all the spurs pale ferruginous; tarsi beneath with yellowish pubescence; all the claws cleft, the inner teeth slightly shorter than the outer.

Basal segments of abdomen very finely and rather closely punctate, becoming quite sparsely so on segments four and

five; segments one to five with white apical fasciae, these dense and broad laterally, narrow medially, rather broadly interrupted on segments four and five; all the segments, including the first, with short black pubescence; the obtuse apex of segment six (which is in fact the transverse carina) slightly emarginate medially, the surface unevenly rugose, the pubescence black and erect, without any pale hairs, the surface beneath the carina slightly excavated and rugose, the morphological apical margin with a rather distinct white fascia but without teeth or carinae; segment seven obtuse, barely visible; ventral plates shining, finely punctate, closely so basally, sparsely so apically; ventral segments two to four with apical white fasciae, interrupted medially on segment three by a tuft of yellow hairs, and rather widely interrupted on segment four, but this segment without the yellow hair-tuft and slightly emarginate medially. Length, 8 mm.; breadth, 2 mm.; length of anterior wing, 6 mm.

Gynandromorphic female.—Almost exactly like the male in structure of head and thorax, having 13-jointed antennae, similar clypeus and mandibles, and answers to the description of the male except that the pubescence of the vertex is more ochraceous, that the recurrent nervures are about equally distant from base and apex of second submarginal cell, and that all the coxae are ferruginous. Also the abdomen dorsally is very similar to that in the male except that the fasciae of segments two to five are rather broadly interrupted medially. It of course differs from the male in having six exposed ventral abdominal plates, but these are ferruginous, punctate and pubescent as in the male, without any evidence of a scopa, segments two to five with broadly interrupted apical white fascia, segments three and four with some longer pale hairs in the center apically; dorsal segment six finely and closely punctate, with short thin pale subappressed hairs and longer erect black ones; ventral segment six with short yellowish pubescence which is dense apically. Length, 8 mm.; breadth, 2.5 mm.; length of anterior wing, 6.5 mm.

Type: Male; Chapada, Brazil, January. [No. 4110, Academy of Natural Sciences of Philadelphia].

Allotype: Topotypical (no date).

Paratypes: Seven males, topotypical, and one from Santarem, Brazil. All of these were collected by H. H. Smith. Two of the males, one of them the specimen from Santarem, have segment six somewhat modified, as it is rather deeply excavated above, and the carina deeply emarginated. Several of the males also have the coxae entirely red as in the allotype.

Factors Affecting Sex

A discussion of the possibilities as to the origin of these anomalous conditions necessitates first a statement or discussion of the nature of the sexual state and of the various factors that are known to have an effect on the sexual condition of an organism.

it is now known that in sexually dimorphic organisms the two conditions are not as separate and distinct from each other as would seem from external appearances. Instead, both sexes are latent in each individual, one of them usually being fully developed and evident, while the other is consequently submerged or hidden. We say the organism is male or female according as to which of the two sexual states has been expressed in the development of the soma. The condition has been described as being in the nature of a balance, and certain factors operating during the development of an individual swing the balance to one side or the other so that the final expression is usually definitely male or female. If anything intervenes to prevent the full expression of one sex or the other, an intermediate condition results which may either be less definitely male or female or may be impossible to assign as either the one or the other. Thus the sexual state has been described as being a quantitive rather than a qualitive condition.

It is apparent that these operative factors are at least closely associated with the chromosomes, as shown by the difference in genetic constitution of the male and female in many species. A familiar and conspicuous example of this is the parthenogenetic development of the drone of the honey-bee. In this insect, the queens and workers (females) develop from fertilized eggs, whereas the drones (males) develop from unfertilized eggs. As a consequence the somatic cells of the drone contain only half as many chromosomes as those of the female. Parthenogenesis occurs in other insects also, and females as well as males are produced, as in the Cynipids and Aphids, but where females are produced it is found that the full complement of chromosomes (the diploid number) is passed on by the omission of a reduction division in the maturation of the egg. Thus in parthenogenesis, those organisms in which the diploid number of chromosomes is found are female, and those in which

only half this number (the haploid number) is found are male. Therefore the difference in the sexual expression of the soma would appear to be due to this difference in the number of chromosomes.

But parthenogenesis is the exception rather than the rule, and in most species the male results from a fertilized egg just as the female. In many forms however there is a difference in the number of chromosomes in the two sexes, the female having an even number of paired chromosomes, while the male has this number reduced by one, one of them consequently being unpaired. This odd chromosome in the male is known as the X-chromosome, as also a pair of corresponding chromosomes in the female. Thus the female has two such chromosomes and is said to be homozygous, while the male with only one is said to be heterozygous, for sex. This difference is brought about during spermatogenesis by a difference in the behavior of the X-chromosome in failing to divide during the final maturation division. Thus half the spermatozoa contain the X-chromosome, half are without it, while it is present in all of the ova; and in fertilization, the zygotes formed by the union of ova and spermatozoa containing this chromosome develop into females, while those resulting from the union of ova with spermatozoa lacking it develop into males. Here again, therefore, it would appear that the deciding factor is the presence or absence of a chromosome.

In still other species the number of chromosomes is the same in each sex, but in some forms the two members of one of the pairs in the male are unequal. One of these that is similar to an equal pair in the female is the X-chromosome, while its unequal fellow, that does not resemble any of those found in the female, is known as the Y-chromosome. Here again, therefore, the female is homozygous, while the male is heterozygous, with an X- and a Y-chromosome. In other forms there is no visible difference in the chromosomes between the sexes, but this does not necessarily prove that there is no actual difference.

Still another indication of the relation between the genetic constitution and sex is seen in some exceptional instances in which a greater number of chromosomes than is usual for the

species was found in certain individuals. These were found to be triploid. Kosminsky (1911) first noticed this condition in lepidopterous larvae that had been subjected to abnormally high temperatures, and offspring from the resulting moths contained sexually abnormal individuals. Bridges (1921) obtained a series of the fruit-fly *Drosophila* that contained normal females, a few normal males, and quite a series of sexually anomalous forms. All of these were the progeny of one female, and upon examination it was found that she had three of the normal two "second" chromosomes or autosomes. Some of the normal females from this culture in turn produced other anomalous forms and were also found to be triploid. Thus in the union of certain ova and sperms zygotes would result having abnormal combinations of these chromosomes, and this is supposed to be the cause of the abnormal condition of the soma. Goldschmidt and Pariser (1923), working with Lepidoptera, obtained some gynandromorphic females that proved to be tripoid, in crosses between two species of Saturnia. Thus abnormal conditions in the chromosomes are associated at times at least with abnormal sexual conditions.

But the mere fact that there is often a difference between the male and female as regards the chromosomes does not necessarily prove that the chromosomes are the direct cause of the sexual condition, or that factors or genes borne by these chromosomes are the effective agents in the development of the organism into a male or into a female. It is the belief of some workers that the difference in genetic constitution is merely another expression of its sexual state rather than the cause of it.

In mammals the effect of the ovary or testis on the secondary sexual characters has long been known. Castration of males at an early period of development results in the nonappearance of certain of the male characters and in the more complete development of female characters that are latent in normal males. Thus the mammary glands in castrated males approach the condition of those in normal females, and in at least one instance the transplantation of ovaries into a male resulted in the complete development of the mammary glands, even to the secretion of milk and the suckling of young (vide Don-

caster 1914, p. 94). It has been shown that it is the interstitial tissues rather than the sexual products that are the apparent causal factors in these changes.

In insects it has been proven that the genital glands have no effect on the appearance of the secondary sexual characters. Castration of various insects in the larval or nymphal stages has never resulted in any visible effect on the soma, and even the transplantation of the genital glands of one sex into the body of the other sex has given definitely negative results.

In the case of certain Crustacea (*Inachus*, the Spider Crab) it was formerly believed that the removal of the testes in the male did have an effect comparable to that in the castration of mammals, because of the visible effect of so-called parasitic castration in that group. But it was later discovered that it was not a case of castration, since the testes were not destroyed by the parasite, although they might become greatly reduced and functionless. Instead, it appears that the parasite removes certain fatty substances from the blood in much the same manner as the ovary acts in the normal female, and therefore functions with respect to the soma as an ovary. Loss of this substance from the blood causes the organism to produce it in excess, so that the blood becomes more richly supplied with it; and this has the apparent effect of changing the soma from the male toward the female type. Analysis of the blood of normal males and females shows a difference in chemical constitution, and in parasitized males the blood becomes chemically like that in normal females. In parasitized females there is no apparent change in the blood or in the soma, although the ovaries may become reduced and functionless just as the testes in the male.

In the insects also there is a chemical difference between the blood of the sexes, suggesting a similarity to the condition in *Inachus*, but according to Geyer (1913) blood transfusions from one sex to the other have no apparent influence on the external sexual characters. And the occurrence of gynandromorphs having contrasting male and female parts makes it appear doubtful that the blood is the deciding factor here; for if it were able to effect the secondary sexual characters it would be expected to

exert an equal influence throughout the body, and consequently gynandromorphs could hardly occur.

In addition to these factors that are inherent in the affected organism, there are various external influences that have been shown to effect the sexual state of an organism, acting of course through internal factors, either some of those that have been touched upon or upon others of which we have no knowledge. One instance of parasitism has already been mentioned, that of *Sacculina* in the Spider Crab, *Inachus*, and the general manner of its effect on the host explained. Other somewhat similar examples occur in related species and groups. In the insects, particularly in certain groups of Hymenoptera and Homoptera, stylopization is a fairly common occurrence. The parasite Stylops develops mostly inside the abdomen of the host, with only the anterior end protruding slightly between two segments. The food is absorbed from the blood of the host into the body of the parasite by osmosis, through the parasite's body wall. No gross internal organs of the host are destroyed, although they may be considerably reduced in size and may lose their function to a greater or lesser degree. It is evident however that external changes observed in the host are not due to the loss of ovaries or testes, although the condition may be comparable to a degree to that in *Inachus*, for it is probably the condition of the blood which brings about the changes. In parasitized bees the two sexes tend to approach each other in their secondary sexual characters, the female assuming certain characters of the male and the male certain of those of the female. A complete change to the secondary sexual characters of the opposite sex has not been observed, however, and males showing the greatest degree of change are yet more male than female, and likewise the females are always more female than male. Also, the degree of change corresponds to the extent of parasitism, and an individual with several parasites tends to show greater modifications than an individual with only one parasite, although the length of time during which the host has been effected must be taken into account. In a recent paper by Salt (1927) the effects of stylopization are discussed in detail, and he comes to the conclusion that it is the extraction of nourishment from the blood of the host that is the primary cause of these changes.

In the Homoptera, the Membracid, *Thelia bimaculata* Fabr., which is parasitized by *Aphelopus theliae* Gahan, a polyembyonic hymenopteran (Kornhauser, 1919) shows changes in the secondary sexual characters in the male sex, which assumes more or less completely the sex characters of the female. Parasitized females, however, do not show corresponding changes toward the male condition. The parasite usually causes the degeneration of the gonads, but in some cases individuals have been found with a completely female soma but with male gonads. The effect is therefore not due to the loss of the gonads. According to Kornhauser it may be due to the less stable heterozygous condition of the male which is affected by the blood that has been altered by the metabolism of the parasite. In his own words, "Extragenital characteristics may be due to genes which in many cases modify characteristics once common to both sexes, but now exhibited in a primitive condition only, in the more stable female. Metabolism of the parasite, altering the constitution of the host's haemolymph which bathes the developing cells, may offer an environment unsuitable for these recent genes to find their expression and leave the male individual in a more primitive state exhibiting characteristics now found in the female of the species."

The role of nourishment in the development of the secondary sexual characters as evidenced in the effects of stylopization has already been mentioned. In the ants, Wheeler (1907) has found workers with enlarged gasters and small heads, due to the presence in the nest of the parasite Mermis, and he has also found worker-female combinations that were apparently due to the infestation of the nest by Staphylinids. Such abnormalities he ascribed to the lack of proper food during the larval stage. Later, (1918) he found combinations of the male and soldier (a female caste). The manner in which the hosts of Stylops are affected is of course somewhat different, but apparently the final effect on the soma is somewhat parallel in the two cases, although not all of the abnormalities found by Wheeler were in the nature of intersexes or gynandromorphs, but in some instances were combinations of two female castes.

Sexual abnormalities have been produced experimentally in insects and in at least two other animal groups as well. These have been produced in several ways, among these being cross-breeding between races of a species or between closely related species. Much of this work has been done by Goldschmidt, experimenting with crosses between European and Japanese races of the Gypsy Moth (Porthetria dispar L.). These crosses resulted in the production of a certain proportion of sexually abnormal individuals, intermediate between the sexes, which he called intersexes. This is caused, he believes, by a difference between these races in the "potency" of the factors causing maleness or femaleness. In the normal offspring of one race the balance between these factors is such that the pendulum is swung definitely one way or the other by the preponderance of one factor over the other; but in racial crossings, where the factors may have different values, certain combinations may result in which there is no great preponderance of one factor over the other, and an intermediate condition results (Goldschmidt, 1916). Riddle (1916), working with pigeons, also obtained intergrades between the sexes by crossing races. He was able to control sex to a degree, in that the offspring of these crossings produced early in the season were males, those late in the season, females, while these graded into each other in mid-season by a series of sex intergrades. He thus concluded that sex is not a qualitative condition, but a quantitative one. Lang (1912) crossed two species of Gasteropods, *Helix hortensis* and *H. nemoralis*, obtaining intersexual conditions in the offspring.

Experimental abnormalities have also been induced in insects through the use of abnormal temperatures. Kosminsky (1911) subjected larvae and pupae of *Porthetria dispar* to abnormally high temperatures in one series of experiments, to abnormally low temperatures in another. In the case of pupae subjected to low temperatures, sexual intergradations in the resulting moths were obtained, while moths obtained from larvae that had been subjected to high temperatures were apparently normal, though small. But two fertile females from the latter group produced among several normal male and female offspring, several mosaic gynandromorphs, and offspring of matings of the normal F_1

generation produced still more gynandromorphs. Examination of larvae subjected to these high temperatures showed that the spermatocytes contained an abnormal number of chromosomes and the resulting offspring were triploid. Emeljanoff (1924), also working with *P. dispar*, obtained a series of intersexual forms by subjecting male pupae to high temperatures and female pupae to low temperatures.

Various experiments have been conducted by several workers endeavoring to obtain heritable modifications by subjecting females to X-rays. Most of the results have been negative, but Mavor (1924), working with *Drosophila*, obtained two bilateral gynandromorphs from the progeny of flies so exposed. A total of 107 females were treated, and the total number of the F_1 generation was 24,469. The original females were exposed to the X-rays in the pupal stage. Cytological examination of these gynandromorphs showed that the X-chromosome that was eliminated in the male parts was of paternal origin and therefore had not been exposed to the rays. Thus the action was indirect, some condition being brought about in the egg which caused the subsequent elimination of the unexposed male X-chromosome.

Still more recently it has been shown that sexual abnormalities may be induced by mechanical shock. Poulton (1927), in an address before the London Entomological Society, quoted an editorial note by Van Someren in which some lepidopterous gynandromorphs that had been produced by mechanical shock were described. These consisted of four females with male admixture and five males with female admixture. The shock was timed when the larval skin was being cast and while the pupa was thus still soft and unset. The shock was administered by knocking the side of the box containing the pupae with the knuckles or with a small mallet. It was proven that this shock was the cause of the abnormal condition through the rearing of unshocked pupae that all produced normal butterflies; and but one wild gynandromorph of this particular species had been caught up to that time. There was also some indication that the soma was most affected on that side that had been most severely shocked. In discussing the possible causes of

this phenomenon, Poulton states that it is evident from the results that the pupa is similar to a Mendelian heterozygote, with the factors for both sexes present, one or the other being dominant, and the recessive one becoming evident by a correctly timed shock. It is the general belief, as we have already pointed out, that all organisms possess the characters of both sexes in at least a latent condition, and it is quite evident that this is the case with these pupae, and the shock, applied just before the general reorganization of the body tissues during the pupal period, evidently causes the affected tissues to change the direction of their development away from one sex toward the other. Just what the mechanism of this process is we do not know with certainty, but the fact that the mechanical shock may incite such changes is apparently proven.

There have been various theories advanced to explain the origin of gynandromorphs, for the most part developed from the hypothesis of the effect of the genetic constitution on the sexual expression of the soma. Gynandromorphs of the honeybee, for example, in which the male develops parthenogenetically, have been explained by several theories. Boveri suggested that it might be due to delayed fertilization, the ovum dividing before the sperm entered it, with the result that only one of the daughter cells combines with the sperm to receive the full complement of chromatin material. Thus tissues resulting from the division of one of these daughter cells would be female, while those of the other, with only the haploid number of chromosomes, would be male. Morgan (1905 a) made an alternative suggestion that it might be due instead to two spermatozoa entering the ovum, one of these uniting with the egg nucleus while the other, having entered the cytoplasm of the egg, proceeds to divide by itself and gives rise consequently to the male parts of the body. According to Boveri's theory the male parts would be of maternal origin, while they would be of paternal origin according to Morgan's, and the available evidence seems to support the first theory. Morgan and Bridges (1919) found that in gynandromorphs of *Drosophila* the male parts are brought about by the elimination of one of the X-chromosomes in the developing female soma, so that the male parts have the XO condition, whereas in normal fertile males

the soma is of the XY constitution. The elimination of the X-chromosome, without the presence of the Y-chromosome, seems to cause the same condition as in the normal male soma. They made the suggestion that gynandromorphs of the honey-bee might be caused by a similar process of elimination.

Wheeler has made several suggestions as to the possible causes of gynandromorphs. First, it is possible that they might arise either from two fused eggs or from a binucleate ovum, only one sperm entering to fertilize or unite with one of the egg nuclei. Second, they might arise as the result of the division of the ovum before fertilization, and either one of the daughter cells fails to become fertilized through the entry of but a single sperm, resulting in the parthenogenetic development of one of them, or else in polyspermy, each egg nucleus becomes fertilized, one of the fused nuclei resulting in female tissues, the other in male tissues. In the latter case it would evidently be necessary for one of the spermatozoa to bear an X-chromosome, while the other would lack it, although it might bear the Y-chromosome. According to this his third suggestion, unisexual gynandromorphs (intersexes ?) may be the result of trophic disturbances in the development of the larva or during the pupal period which might cause changes in the chromosome condition of certain tissues.

Goldschmidt (1917) explains the origin of intersexual forms by assuming that the real sex factors are enzymes located on the chromosomes, these accelerating a reaction in proportion to their concentration. These he names *andrase* and *gynase,* the former being the sex factor for maleness, the latter for femaleness. He gives the following rule as to the origin of these intersexual forms: "A given organ develops, in the case of female intersexuality, on female lines up to a given point, when suddenly the male stimulus starts, and the rest of the development is purely male. The degree of intersexuality is determined by how long the development has been in progress before the turning point occurs". He explains that in the case of the normal male, for example, the higher concentration of of the andrase to the gynase causes the embryo to develop along male lines up to the hatching of the egg, after which the action

of both enzymes stops and the sex of the individual is fixed. If, however, the concentration of the andrase is not as high as normal, its action may be "spent" before the egg hatches, and this allows the less highly concentrated gynase to exert its influence and swing the development over to the female side, on which it completes its development. But he fails to take into account the fact that external influences acting on the post-embryonic stages may exert a similar influence; and this has been definitely proven as shown by the effects of abnormal temperature and of mechanical shock during the larval or pupal period. This would seem to disprove his assumption that the sex of the individual is fixed at the time of the hatching of the egg, at least in the case of insects. The facts would not disprove the theory of the action of enzymes as the real factors located on the chromosomes, however, and (as he explains) many other writers have expressed similar views. The theory was quite fully expanded by Troland (1917) in his paper on "Biological enigmas and the theory of enzyme reaction".

From all these various facts and theories, it would appear that there is a difference in the origin of gynandromorphs and intersexes comparable to their differences in structure. In gynandromorphs, with the distinct regions of male and female tissues, only those explanations based on chromosome behavior would seem to apply, although in certain instances abnormal chromosome behavior has apparently been brought about by external influences, such as temperature and X-rays, acting on the germ cells in the parent. With intersexual forms, the influences at work on the organism apparently have a uniform effect on the entire animal, so that the result is an intermediate but uniform individual, without the contrasting male and female parts. Gynandromorphs probably could not be produced by such influences unless it were possible for them to effect part of the animal, leaving the remaining parts unaffected. This does not seem likely.

Nevertheless, it is possible that in intersexes the changes are due fundamentally to altered chromosome behavior which has been brought about by altered environmental conditions; or, if sexual characters in the soma are due to the presence of

enzymes, as suggested by Goldschmidt, then the changed environment may cause a change in the effect of these enzymes to produce the observed result. If enzymes are the active agents in sex phenomena, it seems quite possible, for instance, that a marked difference in the food taken up by the cells in the process of metabolism may effect the concentration or "potency" of these enzymes located in the cells. Or, these enzymes may be effective only under certain concentrations or chemical conditions of the food elements, and a change in either of these may thus cause the "dominant" enzyme to become ineffective, and the "recessive" one to thus become active. Under normal undisturbed conditions the food carried by the blood is probably more or less uniform chemically, at least within certain limits, being regulated either by the supplies laid up for the larva by the parent or by the feeding habits of the larva, as also by the regulating action of the digestive organs in giving up to the blood the elements necessary to the development of the somatic cells. In certain types of parasitism, where the nutritive elements are absorbed directly from the blood of the host by the parasite, this regulative action may be lost to a degree, and the cells thus receive food that is lacking in certain elements that may be necessary to their full normal development. Nest parasites might produce the same result by appropriating so much of the food that it would be impossible for the host to obtain a sufficiently high concentration of necessary elements in the blood. Whatever the nature of the fundamental reaction, it seems quite probable that the same general law underlies all sex phenomena, both normal and abnormal, and that the observed variations from normal, either as gynandromorphs or intersexes, are due to differences in the inciting factors.

Conclusions

Considering, therefore, all of the facts of sex and all of the various theories of the origin of sexual abnormalities, what are the probabilities regarding the origin of the sex anomalies described in the preceding pages?

First, as a general observation covering all of the material, it would seem that most or all of the specimens are of the nature

of intersexes and are not to be considered true gynandromorphs. The specimen of *M. willughbiella* described by Stenton (see p. 327) is apparently a true gynandromorph, having contrasting male and female parts, but the material described here does not show that type of condition. In most of the specimens, while the male characters are more pronounced anteriorly, there is little or no variation on either side of the median line, and no condition therefore resembling that in the lateral or mosaic gynandromorphs. All of the specimens are apparently females, or at least they started out in their initial development to be females, but the soma is more or less strongly male in character due to a change in direction toward the male at some point in their development, early in some cases, later in others. Some of them might be confused with frontal gynandromorphs, or in a few cases they might be better designated as combinations of the frontal and transverse types, since in many of these the head and thorax are entirely male in character, while the abdomen shows some indication of being divided transversely into a dorsal male portion and a ventral female portion. But where this condition of the abdomen obtains, there is no distinct line of demarkation between the two, and in most cases the female ventral part shows a certain degree of maleness, either in lacking the scopa or in having a thin scopa strongly resembling the normal pubescence of the ventral plates in the male.

It will be noted from the descriptions that the two specimens of *M. vidua* show certain differences from the other material. First, contrary to what has just been stated as being the general condition in most of the specimens, these show a slight indication of a difference in the sexual condition of the two sides, seen in the antennae, for the apical joints in both specimens differ on the two sides (Pl. XXXII). In one specimen the right antenna is 13-jointed, while the left is 12-jointed, but with an indication of a division of the terminal joint in the latter. In the other specimen the left antenna has a very slight indication of this division of the terminal joint, but none at all on the right, both being 12-jointed. This would seem to indicate three possibilities; first, that the specimens are really gynandromorphs of the frontal type, but with this

slight tendency toward the bilateral condition; second, that they are intersexes, but that the two sides are not exactly parallel in their development, so that at the time of change from the female to the male type of development, one antenna was a little more fully developed than the other and therefore did not have the male characters so fully impressed upon it; or, third, that if the two sides are exactly parallel in development, the change of direction from the female toward the male was to a slight degree at least, progressive, not affecting all the tissues simultaneously, and the antenna that became affected first became more fully male than the other. These two latter possibilities are also indicated by the difference in condition between the two specimens, for in one the antennae have proceeded further toward the male condition and the dorsal abdominal segments less so, than in the other one. Thus either the various body parts, with reference to each other, are not always developed to the same degree at any given time, or else the change is progressive rather than simultaneous. Of these two possibilities, the last would seem the more probable.

But if these two specimens are intersexes and such a change in direction of development occurred, what could have caused the change? Most of the various factors that have been observed to cause such conditions in other insects can apparently be eliminated as being unlikely or improbable, not only in the case of these two specimens but in all the remainder of the material as well. It seems hardly possible, for instance, that they could have been caused by mechanical shock, judging both from the type of abnormality and from the manner in which the immature stages are protected in the nests. It is inferred in the descriptions of the lepidopterous gynandromorphs caused by mechanical shock that the two sides are not affected equally, since it is stated that the side suffering the most from this shock is apparently most affected. Of course it is possible that certain shocks would affect both sides equally, but not always, and it would be unlikely that two specimens of a species, or that any amount of material such as we have at hand, rendered abnormal by the effects of shock, would be as nearly bilaterally symmetrical as the larger part of this material. Moreover, for the shock

to be effective it is apparently necessary that it be administered at just a certain time during the pupal period, before the tissues have been reorganized and "set", and the manner in which the larvae and pupae are protected, being enclosed in a nest composed of leaves hidden away in the ground or in burrows in wood, would seem to insure against accident of this kind.

It also seems unlikely that these would have been caused by abnormal temperatures, due again to the protective nests and nest sites, and to the improbability of the normal temperature range of a region causing any effect of this kind. Otherwise, we might expect an extremely hot summer or cold winter to be followed by the occurrence of numbers of these abnormal forms. It is true, that the larvae or pupae in these nests might be exposed to abnormal temperature ranges by accidents, such as the falling and shattering of an old tree, exposing the nests in the wood or opening up the nesting sites in the ground by the tearing up of the roots. Moreover, it must also be admitted that such accidents occurring at a time when some of the larvae were pupating, might so shock them as to cause changes such as Van Someren noted in the Lepidoptera. Admitting the possibility, however, the probability seems extremely slight in both of these cases.

That these are the result of crossing of races or closely related species also seems very unlikely, and there is nothing in the specimens to indicate this possibility. In these specimens of *vidua* the female parts seem to be as definitely those of *vidua* as the male parts, and a crossing, unless it be between races that are very similar in external appearances, would be expected to show some evidence of the mixed strain in the external characters; and we would expect races to be more or less separated geographically.

Parasitism seems to be the only possibility left, and while there is no external evidence of such a condition, there is less evidence against the theory than against those already cited. The occurrence of these two similar specimens of *vidua* in neighboring localities, but in different years, would seem to indicate some common inciting factor beyond a mere accident, and it would also seem quite reasonable to assign this action to a parasite of some sort. Just what the parasite may be, and

its manner of attacking the host, can hardly be ascertained from a study of the available material. Most of the parasites of the solitary bees kill the host larvae before they reach the pupal stage, and this seems to be the case with *Coelioxys* and with the species of *Leucospis* that are known to be parasitic on species of *Megachile*. It is known that these gradually suck the juices from the host larva and kill it only after feeding upon it for some time, finally leaving only the empty larval skin. Thus if the parasite larva were interferred with during this process, before the host larva had been killed, it seems possible for a condition comparable to that in stylopization to arise through the extraction of these juices. Moreover, this interference might conceivably occur through the presence of a hyperparasite, this killing the primary parasite before the host larva had been killed. It might be objected here, of course, that in such cases, after killing the primary parasite, the hyperparasite would possibly continue its feeding on the host and kill it too. Another possibility is the presence of some other unknown parasite that affects the host only during the larval period and does not kill it ordinarily. Or it might be due to some internal parasite such as a Protozoan or a Nematode, which would show no external evidences of their presence other than the structural modifications of the host, when such occurred.

The condition in the single specimen of *M. parallela* is apparently quite similar to that in the specimens of *vidua*. It is not a gynandromorph, as shown by its uniform bilateral symmetry and the intermediate condition of the antennae (Pl. XXXII) and of the dorsal abdominal segments. In this specimen the antennae are uniform as to their sexual condition, which would indicate that they were very nearly parallel in their development and that the progressive change in direction of development, if such exists, reached the apical antennal joints simultaneously. The fact that the head and thorax are entirely male in character except for the intergrading character of the antennae seems to be an additional indication, however, of the progressive nature of this change, which here apparently reached the apices of the antennae too late to change them entirely

to the male type, whereas all the other parts were entirely changed.

The intersexual specimen of *M. gemula* has proceeded further toward the male condition than the specimens of either *vidua* or *parallela*, as shown by the definitely male character of the head and thorax, including the antennae and legs, and the four basal segments of the abdomen. In the abdomen only the fifth and sixth segments show any of the characteristics of the female, both the dorsal and ventral plates of the other segments showing entirely male characters. Thus the change of direction from the female to the male type evidently occurred early in this individual, so that in its somatic characters it was changed almost completely to a male. It would be possible to confuse this with a gynandromorph, since there seems to be a rather sharp line of division between the male and female portions of the body, but the two apical female segments of the abdomen are not quite typical for the female, the scopa of the ventral plates being golden-brownish instead of black in color.

The fact that this specimen of *M. gemula* reacted psychologically as a male is of interest as indicating the effect, or rather lack of effect, of the genital glands on the reactions of insects. In this respect there is evidently a difference between the insects and mammals comparable to the difference in the effect of the genital glands on the secondary sexual characters in these two groups. In addition, it is evident that maleness in this case is not confined to external structure alone, but those regions showing male external characters are male even to the nerve centers that control the actions of the individual. The fact that insects do not have a central nervous system controlling all parts of the body may explain the reactions of these intersexes. Since the ganglia controlling the nervous reactions of the head, thorax and abdomen are separated and located in these regions, the head and thorax might be expected to show male reactions in such a specimen as this one, those regions being definitely male in structure, but it is possible that the abdomen might show a female type of reaction. Whiting (1927) has observed such mixed reactions in *Habrobracon* gynandromorphs.

The specimen of *M. perihirta* might be confused with a mosaic gynandromorph, but it is certainly an intersex as shown by the intermediate condition of the front coxae, the front and middle metatarsi, and the apical ventral segments of the abdomen. The change in direction of development evidently occurred at a relatively late stage, and the male characters are therefore not so completely developed as in the specimens of *vidua*, *parallela* and *gemula*. Those parts showing the greatest degree of femaleness are the antennae, the apical portions of the front and middle legs, and the entire hind legs. This specimen therefore affords some further indications of the progressive nature of the change in direction of development, since it would seem reasonable to suppose that in the case of such a change, the appendages, particularly their apical parts, would be affected last.

The two specimens of *M. bertonii* and the single specimen each of *M. tapytensis* and the undetermined *Megachile* intersex from Brazil and Paraguay all exhibit approximately the same conditions and are quite similar to the anomalous specimens from North America. In this tropical material, however, the head and thorax in most cases seems to be entirely male in character, without any female intergradation, even in the antennae. Here also, parasitism would appear to be the only possibility among the known causal factors. As indicated in the descriptions, the specimens of *bertonii* were found in a considerable series of normal specimens, which would tend to prove that they are really anomalous and not normal specimens of a species similar to that which Cockerell described as the new genus *Androgynella* (see p. 327).

It will be recalled that he obtained a considerable series of females of this Australian species, all in an anomalous condition regarding the secondary sex characters, and he concluded that in this species the females had assumed the male secondary sex characters as the normal condition, and, lacking the scopa, were parasitic in habit. The later discovery of a similar condition in a species from the Philippines, but this time in a less stable condition, tended to throw doubt on his first assumption, and this is greatly increased by this anomalous material from America. That the normality of these females of *Androgynella*

is rather doubtful is also indicated by the fact that parasitized individuals show a tendency to appear earlier than normal females. This has been shown to be the case in stylopized bees (vide Salt, 1927, p. 275) and it seems quite possible that the same would hold true for the bees when affected by other parasites. If, therefore, these anomalies are due to some form of parasitism, it is quite likely that collections made during the early part of the period of flight of a species subject to this parasitism would tend to show a high percentage of parasitized females and of males (since the males tend to appear sooner than the females normally). It would be quite possible therefore to collect a series of males and anomalous females without obtaining any normal females. A slight indication that this is actually the case is seen in these specimens of *bertonii,* for the labels for all the normal specimens of this series are printed, whereas those for the two abnormal specimens are in handwriting, suggesting the possibility that these two specimens were captured earlier than the others, before printed labels had been made. It is unfortunate that more complete data was not kept on this material, for these two specimens are not dated.

There is none of this anomalous material in which the indications of parasitism are shown to better advantage than in *M. intergradus.* In the material of this species there is a quite evenly graded series, as shown in the table on page 343, including normal females, slightly modified individuals, and others showing rather advanced degrees of maleness. These exhibit a condition very similar, therefore, to that seen in crabs parasitized by Sacculina, in Membracids parasitized by Aphelopus, and in stylopized bees, where the degree of change is dependent either upon the degree of parasitism or upon the length of time during which the host has supported the parasite. A dissection of the abdomen of one of the No. 2 sex intergrades was made, the contents being removed and examined for evidences of the presence of parasites. It was thought that in the case of an insect parasite some of the chitinous integument would still be in evidence in the abdomen. The internal tissues had naturally become thoroughly dried out and hardened, but after removal they were softened in water and carefully examined without finding any traces of a parasite. Apparently, then, if the con-

dition were due to parasitism, the parasite had either escaped from the host during its immature stages, or else it belongs to some other group than the Arthropoda and its presence is therefore not indicated by any chitinous exoskeleton. The fact that the specimens of this species are larger than any of the other anomalous specimens from the same region is possibly worthy of note. It is barely possible that the same parasite has affected all of these, and that its effect is less marked in the larger individuals where a proportionately smaller amount of nourishment would be required of the host to bring the parasite to maturity.

The anomalous condition is more conspicuous in the five specimens of *M. dilatata* than it is in any of the other described forms. They are females, as shown by the venter of the abdomen, with its scopa and an evident sting, but the head and thorax are entirely male in character, so far as can be judged at least without a normal male for comparison. At first glance it would appear that these specimens indicate a higher degree of femaleness than the others, due to the scopa, but certain of the male characters are extreme in their development, indicating a contrasting high degree of maleness. In addition, it is possible that the normal male of this species has long and dense pubescence on the ventral abdominal plates, comparable to the female condition, and that the abdomen is male in character except for the apical definitely female segments. The male character of the antennae is very conspicuous, since the apical joints are extremely widely dilated, more so than in most if not all normal males in this genus (Pl. XXXII). In four of the specimens the antennae are 13-jointed, but in the fifth they are definitely 12-jointed. The condition of the apical joint in this last specimen is not comparable to that in the specimens from North America, however, in which the added joint in the male is apparently brought about by a division of the twelfth joint into two parts, as seen by the partial division of the apical joint in the intersexual forms, for in this case the apical joints are the same as in the 13-jointed antennae, being fully as widely dilated, and there is no indication of a division of any of the joints.

There are three possibilities, therefore, that are indicated

in this series of *dilatata*. First, it is possible that these also are intersexual forms, caused by the presence of parasites during larval growth; second, they may be true frontal gynandromorphs, with a male head and thorax and a female abdomen; or, third, they may be normal females of a gynandromorphic species.

As evidence for the first alternative there is the fact of the occurrence of all of these other apparently parasitized anomalous forms from the same general region in which these were caught, and it is quite possible of course that these are of the same general nature. The variability of the condition suggested by the difference in the number of antennal joints in one of the sepecimens also indicates an intersexual rather than a gynandromorphic condition, although the fact that the apical joints in the 12-jointed antennae are not differentiated from those in the others casts some doubt on this.

The more or less strongly contrasting sexual characters of the abdomen and of the head and thorax is suggestive of a gynandromorphic condition, although, as it has already been shown, the degree of femaleness of the abdomen is open to question. The occurrence of the series of five specimens also casts some doubt on their gynandromorphic character, since such anomalies are extremely rare, at least in the wild state. Nevertheless, cases have been cited where influences acting on the germ plasm of insects in the larval or pupal state have resulted in the production of abnormal offspring. The temperature experiments of Kosminsky and Emeljanoff (see pp. 358 and 359), and the production of gynandromorphs from an X-rayed mother are examples of this. Moreover, there are instances on record where in a certain strain or race there is exhibited a tendency to the production of sexually abnormal forms. One such case is the occurrence of triploid intersexes in a strain of *Drosophila*, discovered by Bridges (see p. 354), but the classic example is the Eugster hive of honey-bees. In this instance two hundred or more gynandromorphs were obtained over a period of two or three years, all being the progeny of one queen. Disregarding here the various explanations of these occurrences that have been advanced (see p. 360), it is evident that it is possible for several gynandromorphic individuals to occur in the same strain,

and the mere fact therefore that several similar anomalous specimens occur in a series does not disprove their gynandromorphic nature. If these are true gynandromorphs, it is difficult to imagine what could have caused their occurrence, and lacking any suggestive data, no attempt to explain them will be made here, especially as their gynandromorphic state is to be questioned.

Much of the available evidence would seem to support the third alternative, that these are normal females of a gynandromorphic species. The most damaging piece of evidence, so far as this theory is concerned, however, is the variation in the number of antennal joints, and until the discovery of this variation, the theory seemed to be the most logical of the three. Not much can be given to prove or disprove the theory with the limited amount of material at hand, lacking as we do the male, and being unable to refer the specimens to any described species. Additional material from this region, with all possible collecting data, especially any facts that might aid in the association of the sexes of any of the species of *Megachile* of the region, will possibly solve the problem at some future time.

The condition in *M. chapadiana* is possibly somewhat similar to that in *dilatata,* although here also, any definite conclusions are impossible without additional material, especially of the females. In the male, the extreme development of the pubescence on the venter of the abdomen to a degree comparable to the scopa in the female, and the fact that the female has a similar scopa and a considerable degree of maleness in the head and thorax, suggest the possibility that the sexes in this species are approaching each other in character. This would be dependent, however, on the fact that the female is a normal specimen, and this is not at all certain. The occurrence of the males in the series in two localities indicates that they at least are normal; but with the lone female this can hardly be proven. On the contrary it is quite possible that the female is a parasitized and consequently abnormal individual, and that the similarity of the scopa to the ventral brush in the male is thus merely another male character. But in the characters of the head and thorax the degree of maleness is less marked than in

most of the other anomalous specimens. With only this one damaged female specimen it is impossible to decide whether the condition is similar to that in these others described here in which the action of a parasite is supposed to be the inciting factor, or whether it is a normally gynandromorphic species. The fact that such instances have been noted in the ants (see p. 325) suggests the possibility of a similar occurrence in the bees, even though the two recorded instances of this character in the bees (Androgynella) are open to debate.

Just as in the case of *chapadiana,* so with the last of these described anomalies, *M. uniformis,* it is difficult to decide whether the lone female of the series is a normal or an abnormal specimen. It is quite possible here also that the punctate, fasciate and short pubescent venter is just another expression of maleness caused by the presence of a parasite. Nevertheless, the appearance does not suggest an abnormal condition so much as it does a normally gynandromorphic species; and if this is a normal female, the species must be parasitic, lacking as it does the means of transporting pollen to its nest. This species might therefore be placed in the genus *Androgynella,* since it agrees with the description of that genus in the lack of a scopa and in the 13-jointed antennae of the female. But the validity of this genus has been questioned here; and even if the genus is valid, this species is probably more closely related to certain of the Neotropical species of normal *Megachile* than it is to the Australian species for which the genus was erected; and also, there is no certainty as to the normality of this single female. It seems preferable, therefore, to merely indicate these various possibilities, and if any of these should prove in the future to be a fact, then the question of generic designation can be settled.

It is possible also that this female of *uniformis* is a true gynandromorph, although if such is the case, the female characters are confined to the apical segments of the abdomen and probably the sex organs and glands, while all the remainder of the soma is male. If this should prove to be the case, a possible method of the origin of parasitism is suggested, especially of the origin of those parasites that are closely related to their hosts. Assuming the occurrence of a gynandromorph having largely male somatic characters, resulting in the absence of the

scopa, it is certain that the only way in which it could provide for any progeny would be to deposit its eggs in the nests of other normal individuals. Also, it is possible that these eggs would be deposited during the time that the rightful owner was stocking it with pollen and before it had laid its own egg, so that the "parasite" egg would tend to hatch first, and the resulting larva would have a corresponding advantage over the "host" larva. Such progeny would quite possibly have transmitted to them a tendency toward the anomalous condition of the parent, and the condition might thus be retained in future generations. It must be admitted that this seems rather fanciful, and there are also certain objections which should be acknowledged. For instance, it seems to be the rule that the anterior end of a frontal gynandromorph rules the reactions of the insect, and that if, therefore, the head and thorax are male, it will act as a male, regardless of the fact that it has ovaries, a sting, etc. This was demonstrated in the case of *M. gemula* which Crawford caught trying to copulate with a female (see p. 334). But according to Whiting (1927) gynandromorphs of *Habrobracon* of this same general type, with the head and thorax male and the abdomen female, will occasionally exhibit female reactions corresponding to the posterior end of the body. This, then, would indicate the possibility of such forms reacting as normal females upon occasions, thus possibly becoming fertilized and ovipositing. And even unfertilized individuals might oviposit, resulting in the production of males, which might transmit the tendency toward gynandromorphism to their progeny.

It might also be objected that a form such as *uniformis* would be more apt to arise as the result of parasitic habits, finally losing the scopa, as in the case of *Psythirus,* and even taking on these other male characters, as suggested by Cockerell in his description of *Androgynella.*

In conclusion, three possibilities as to the origin of these anomalous forms are evident, judging from the appearance of these specimens and from the various facts and theories as to the origin of similar conditions in other groups. Parasitism seems to be the most likely of these three alternatives, although

no external evidences of the presence of parasites can be found, and no internal evidences in the one case in which this was investigated. It is also possible that some of them are true gynandromorphs, caused by the abnormal behavior of the chromosomes in the formation of the somatic tissues, resulting in male instead of female secondary sex characters. And in two or three of the species it appears possible that they are normal females of species that are normally gynandromorphic, similar to those few instances that have been discovered in the ants, where the male is normally ergatandromorphic.

It is to be hoped that in the future collectors in this group of insects will keep this problem in mind, particularly those who have an opportunity to collect in tropical regions where the condition is apparently more commonly met with. When such anomalous specimens come to hand, all possible data that can be obtained should be kept, and as long a series of the species as possible collected, whether abnormal or normal. Also, much might be learned from a cytological examination of the tissues if specimens could be immersed in a killing fluid as soon after capture as possible, thus preserving the tissues in a condition for sectioning. A gross examination of the internal conditions in fresh material may reveal the causal organism, if this condition is due to parasitism, but all possible care should be used to injure the specimens as little as possible unless a considerable series has been obtained.

Acknowledgments

None of this anomalous material was collected by me personally, hence credit is due to the several persons and institutions that have so kindly loaned me the specimens. A large part of the material was received from the Academy of Natural Sciences of Philadelphia, through Mr. E. T. Cresson, Jr., and other specimens were found in collections sent to me by Dr. Reinhold Meyer, of Darmstadt, Dr. George Salt, at Bussey Institution, Professor M. H. Swenk, of the University of Nebraska, Dr. H. B. Hungerford, of the University of Kansas, and Professor H. A. Scullen, of Oregon Agricultural College. To all of these I wish to give my sincere thanks.

I owe especial thanks to Mr. J. C. Crawford, of the North Carolina Department of Agriculture, for the loan of the specimen of *Megachile gemula* and for the notes on the circumstances of its capture, as also for his kindness in agreeing that I should publish this account of it.

To my colleagues in the Department of Zoology at North Carolina State College, Dr. Z. P. Metcalf and Dr. L. H. Snyder, I am indebted for assistance and suggestions. To Dr. Metcalf, from whom I received my original instructions in the preparation of illustrations and much of my instruction in taxonomy, I owe thanks for assistance in these fields. And I am indebted to Dr. Snyder for checking over this paper and offering certain suggestions regarding the genetics which it includes.

For many helpful suggestions as to the possible conditions in this anomalous material I am especially indebted to Dr. W. M. Wheeler, from whom I have received much encouragement in the preparation of this paper. But I am more especially indebted to him for imparting to me something of his enthusiasm for the broader generalizations in Biology, which has given me a better perspective, without, however, destroying my interest in taxonomy or my belief in its importance.

BIBLIOGRAPHY

BANTA, A. M. 1916..A sex intergrade strain of Cladocera. *Proc. Soc. Exp. Biol. and Med.*, XIV, p. 3-4.

1918..Sex and sex intergrades in Cladocera. *Proc. Nat. Ac. Sci.*, IV, p. 373-379.

BERLAND, L. 1925..Episyron capitierassus. *Bull. Soc. Ent. France, Paris*, 1925, p. 44-45.

BISCHOFF, H. 1913..Ein interessanter Hymenopterenzwitter. *Zeitschr. wiss. Insektenbiol. Berlin*, IX, p. 53-54.

BRIDGES, C. B. 1921..Triploid intersexes in Drosophila melanogaster. *Science*, n. s., LIV, p. 252-254.

BRYAN, E. H. Jr., AND OTHERS, 1926..Insects of Hawaii, Johnston Island and Wake Island. *Bull. Bernice P. Bishop Mus. Honolulu*, XXXI, p. 1-94.

COCKAYNE, E. A. 1914..Gynandromorphism. *Trans. London Nat. Hist. Soc.*, 1914, p. 75-85.

1915..Gynandromorphism and kindred problems. *Journ. Genetics*, V, No. 2, p. 75-131.

1916..The relation between the secondary sexual characters and the gonads and accessory glands in insects. *Trans Ent. Soc. London,* 1916, p. 336-342.

COCKERELL, T. D. A. 1911..Androgynella detersa. *Ann. and Mag. Nat. Hist.,* (8) VI, p. 313.

1918..Androgynella subrixator. *Phil. Journ. Sci.,* D, XIII, p. 140.

CRAWLEY, W. C. 1920..Monomorium floricola Jerd. *Ent. Rec.,* XXXII, No. 12, p. 217.

CRAWLEY, W. C. AND BAYLIS, H. A. 1921..Mermis parasitic on ants of the genus Lasius. *Journ. R. Micro. Soc.,* 1921, p. 353-372.

CREWS, F. A. E. 1926..Abnormal sexuality in animals I, Genotypical. *Quart. Rev. Biol.,* I, p. 315-359.

1927a..Abnormal sexuality in animals II, Physiological. *Quart. Rev. Biol.,* II, p. 249-266.

1927b..Abnormal sexuality in animals III, Sex reversal. *Quart. Rev. Biol.,* II, p. 427-441.

DALLA TORRE, K. W. V, AND FRIESE, H. 1899..Die hermaphroditen und gynandromorphen Hymenopteren. *Ber. d. Nat.-Med. Ver., Innsbruck,* XXIV, p. 1-96.

DONCASTER, L. 1914..The determination of sex. *Univ. Press Cambridge.*

DONISTHORPE, H. ST. J. K. 1915a..Gynandromorphs of Myrmica scabrinodis. *Ent. Rec. London,* XXVII, p. 258-260.

1915b..A gynandromorphous ant. *Proc. Ent. Soc. London,* 1915, p. XCVI.

1916..A gynandromorphous ant. *Proc. Ent. Soc. London,* 1916, p. lxxviii.

EMELJANOFF, N. 1924..Intersexualitat bei Lymantria dispar L. unter Einwirkung der Temperatur. *Biol. Zentralbl.,* XLIV, p. 106-110.

EMERY, C. 1924..Casi di anomalia e di parassitismo nelle formiche. *Rend. Acc. Sci. Bologna,* (n. s.) XXVIII, p. 82-89.

ENDERLEIN, G. 1913..Ein hervorragender Zwitter von Xylocopa mendozana aus Argentina. *Stett. Ent. Zeit.,* LXXIV, p. 124-140.

ENGELHARDT, V. V. 1915..Ueber den Bau der gynandromorphen Bienen. *Zeitschr. wiss. Insektenbiol. Berlin,* X, p. 161-167.

FREY GESSNER, E. 1892..Chalicodoma muraria Retz. *Mitt. Schweiz. entom. Ges.,* VIII, p. 372-373.

GERSTACKER, C. E. A. 1863..*Ber. wiss. Leist. Ent. w. d. Jar.,* 1861, p. 292.

GEYER, K. 1913..Untersuchungen ueber die chemische Zusammensetsung der insektenhaemolymphe und ihre Bedeutung für die geschlechtiche Differenzierung. *Zeitschr. f. wiss. Zool.,* CV, p. 349-499.

GIARD, A. 1886..De l'influence de certains parasites rhizocephales sur les caracteres sexuels exterieurs de leur hote. *C. R. Acad. Sci.,* CIII, p. 84-86.

1887a..La castration parasitaire et son influence sur les caracteres exterieurs du sexe male chez les crustaces decapodes. *Bull. Sci.,* XVIII, p. 1-28.

1887b..Sur les parasites Bopyrieus et la castration parasitaire. *C. R. Soc. Biol.,* XXXIX, p. 371-373.

1887c..Sur la castration parasitaire chez l'Eupagarus Bernhardus Linne et chez la Gebia stellata Montagu. *C. R. Acad. Sci.*, T CIV, p. 1113-1115.

1888a..La castration parasitaire. Nouvelles recherches. *Bull. Sci.*, (3) I, p. 12-45.

1888b..Sur la castration parasitaire chez les Eukyphotes des genres Palaemon et Hippolyte, *C. R. Acad. Sci.*, CVI, p. 502-505.

1889..Sur la castration parasitaire des Typhlocyba par une larve de Hymenoptere (Aphelopus melaleucus Dalm.) et par une larve de Diptere (Ateleneura spuria Meig.). *C. R. Acad. Sci.*, T CIX, p. 708-710.

1904..Comment la castration agit-elle sur les caracteres sexuels secondaires? *C. R. Soc. Biol.*, LVI, p. 4-7.

GOLDSCHMIDT, R. 1916..Experimental intersexuality and the sex problem. *Am. Nat.*, L, p. 705-718.

1917..A further contribution to the theory of sex. *Journ. Exp. Zool.*, XXII, p. 593-611.

1920..Untersuchungen ueber Intersexualitat. *Zeit. f. induc. Abstamm.*, XXIII, p. 1-199.

1922..Untersuchungen ueber Intersexualitat II. *Zeit. f. induc. Abstamm.*, XXIX, p. 145-185.

1923..Ein weiterer Beitrag zur Kenntnis des Gynandromorphismus. *Biolog. Zentralbl.*, XLIII, H. 5, p. 518-528.

1925..Ueber die Erzeugung der hoeheren Stufenmaennlicher Intersexualitat bei Lymantria dispar. *Biol. Zentralbl.*, XLV, p. 134-136.

GOLDSCHMIDT, R. AND KATSUKI, K. 1927..Erblicher Gynandromorphismus und somatische Mosaikbildung bei Bombyx mori L. *Biolog. Zentralbl.*, XLVII, p. 45-54.

GOLDSCHMIDT, R. AND PARISER 1923..Triploid intersexes in Lepidoptera. *Biolog. Zentralbl.*, XLIII, p. 446-452.

GOLDSCHMIDT, R. AND POPPELBAUM, H. 1914..Erblickkeitsstudien am Schmetterlingen II. *Zeitschr. induc. Abstamm.*, II, p. 280-316.

GRAENICHER, S. 1905..Some observations on the life history and habits of parasitic bees. *Bull. Wis. Nat. Hist. Soc.*, III, p. 153-167.

1906..On the habits and life history of Leucospis affinis (Say), a parasite of bees. *Bull. Wis. Nat. Hist. Soc.*, IV, p. 153-159.

HEYMONS, R. 1915..Tenthredella livida. *S. B. Ges. naturf. Fr. Berlin*, 1915, p. 1-4.

HICKS, C. H. 1926..A gynandromorphic bee of the genus Dianthidium. *Am. Nat.*, LX, p. 199-200.

JOYET-LAVERGNE, PH. 1925..Sur les reaction d'un tissue au parasitisme; la lipoidogenese et la lipogenese. *C. R. Acad. Sci.*, CLXXX, p. 878-880.

KELLOGG, V. L. 1904..Influence of the primary reproductive organs on the secondary sexual characters. *Journ. Exp. Zool.*, I, p. 601-605.

KOPEC, S. 1911..Untersuchungen ueber Kastration und Transplantation bei Schmetterlingen. *Arch. Entwick. Mech.*, XXXIII, p. 1-116.

1913..Nochmals ueber die Unhabhangigkeit der Ausbildung sekundarer Geschlechtscharaktere von den Gonaden bei Lepidopteren. *Zool. Anz.*, XLIII, p. 65-74.

KORNHAUSER, S. I. 1919..The sexual characteristics of the Membracid Thelia bimaculata Fabr. I. External changes induced by Aphelopus-theliae Gahan. *Journ. Morph.*, XXXII, p. 531-636.

KOSMINSKY, P. 1911..Weitere Untersuchungen ueber die Einwirkung ausserer Einflusse auf Schmetterlinge. *Zool. Jahrb., Abth. f. Allgemeine Zool.*, XXX, p. 321-338.

1924a..*Rev. Zool. Russe. Moscow*, IV, 1 and 2, p. 186-209.

1924a..Experimentelle Erhaltung gynandromorpher Schmetterlinge bei Lymantria dispar L. *Rev. Zool. Russe. Moscow*, IV, 1 and 2, p. 186-209.

1924b..Der Einwirkung ausserer Einflusse. *Biol. Zentralbl.*, XLIV, p. 66-68.

LANG, A. 1912..Vererbungswissenschaftliche Miszellen. *Zeitschr. f. induc. Abstamm.*, VIII, p. 233.

LA VAULX, R. DE 1919..L'intersexualite chez un Crustace Cladocere. *C. R. Acad. Sci.*, CLXIX, p. 97-99.

1920..Les Cladoceres intersexues et les recentes theories du gynandromorphisme. *Bull. Soc. Zool. France*, XLV, p. 38.

1921..L'intersexualite chez un crustace Cladocere. *Bull. Biol. Fr. et Belga.*, LV, p. 1-86.

LOMNICKI, J. 1924..Sur les trois gynandromorphes de la fourmi Myrmica rugulosa Nyl. *Kosmos Bull. Soc. polonaise Naturalister, Lemberg*, XLIX, p. 817-830.

MAIDL, F. 1912..Ueber einem Fall von lateraler Gynandromorphie bei einer Holzbiene (Xylocopa micans Lep.). *Wein. Verh. Zool. Bot. Ges.*, LXII, H. 1, p. 19-26.

MATAUSCH, I. 1909..Gynandromorphic Membracidae. *Journ. N. Y. Ent. Soc.*, XVII, p. 165.

1911..The effects of parasitic castration in Membracidae. *Journ N. Y. Ent. Soc.*, XIX, p. 194-196.

MAVOR, J. W. 1924..Gynandromorphs from X-rayed mothers. *Am. Nat.* LVIII, p. 525-529.

MEHLING, E. 1915..Ueber die gynandromorphen Biene des Eugsterschen Stockes. *Verh. Phys.-Med. Ges. Wursburg.*, XLVIII.

MEISENHEIMER, J. 1907..Ergebnisse einiger Versuchsreihen ueber Extirpation und Transplantation der Geschlechtsdrusen bei Schmetterlingen. *Zool. Anz.*, XXXII, p. 393-400.

1909..Ueber die Beziehungen zwischen primaren und sekundaren Geschlechtsmerkmalen bei den Schmetterlingen. *Naturwiss. Wochenschrift*, (n. s.), VIII, p. 545-553.

1924..Experimentelle Studien sur Soma- und Geschlechtsdifferenzierung. *Zool. Jahr. f. Allgem. Zool. Jena*, XLI, H. 1, p. 1-90.

MORGAN, T. H. 1905a..An alternative interpretation of gynandromorphous insects. *Science*, XXI, p. 632.

1905b..The cause of gynandromorphism in insects. *Am. Nat.*, XLI, p. 715.

1909..A biological and cytological study of sex determination in Phylloxerans and Aphids. *Journ. Exp. Zool.* VII, No. 2, p. 239-352.

1916..The Eugster gynandromorph bees. *Am. Nat.*, L, p. 39-45.

1920..Variation in the secondary sexual characters of the Fiddler Crab. *Am. Nat.*, LIV, p. 220-246.

MORGAN, T. H. AND BRIDGES, C. B. 1919..The origin of gynandromorphs. *Carnegie Institution of Washington*, Publ. No. 278, p. 1-122.

MORICE, F. D. 1915..Remarkable Hymenoptera. *Proc. Ent. Soc. London*, 1915, p. lxxxii.

OUDEMANS, J. TH. 1898..Falter aus castrirten Raupen. *Zool. Jahrb., Abth. f. Syst.*, XII, p. 71-88.

PEACOCK, A. D. 1924..Saw-fly Pristophora pallipes. *Brit. Journ. Exp. Biol. Edinburgh*, I, p. 391-412.

1925..Pteronidea (Nematus) ribesii Scop. *Brit. Journ. Exp. Biol. Edinburgh*, III, p. 61-84.

PEREZ, J. 1879..Des effets du parasitisme des Stylops sur les apiares du genre Andrena. *Rev. Internat. Sci.*, p. 281.

1884..Les apiares parasites au point de vue de la theorie de l'evolution. Bordeaux, 1884.

1886..Des effets du parasitisme des Stylops sur les apiares du genre Andrena. *Actes Soc. Linne Bordeaux*, XL, p. 21-60.

PERKINS, R. C. L. 1905..Leaf-hoppers and their natural enemies III, Stylopidae. *Rep. Exp. Sta. Haw. S. P. Asso. Bull.*, I, Pt. 3, p. 90-111.

1914..Two hermaphrodites of Andrena. *Ent. Mag.*, L, p. 218.

1915..Two hermaphrodite specimens of Andrena. *Ent. Mag.*, LI, p. 191.

1918..Further notes on Stylops and stylopized bees. *Ent. Mag.*, LIV, p. 115-129.

1922..Three hermaphrodite bees. *Ent. Mag.*, LVIII, p. 17-18.

1924..Amauronematus. *Ent. Mag.*, LX, p. 139.

POTTS, F. A. 1906..The modification of the sexual characters of the hermit crab caused by the parasite Peltogaster—Castration parasitaire of Giard. *Quart. Journ. Micro. Sci.*, L, p. 599-621.

POULTON, E. B. 1927..On certain effects of shock upon insect development. *Proc. Ent. Soc. London*, I, p. 1-23.

PROCHNOW, O. 1927..Gynandromorphismus und Intersexualitat in "Die Farbung der Insekten." *Handb. d. Entom.*, XXV, & XXVI, p. 511-522.

REGEN, J. 1909..Kastration und ihre Folgeerscheinungen bei Gryllus campestris L. ♂, I Mitteilung. *Zool. Anz.*, XXXIV, p. 477-478.

1910..Kastration und ihre Folgeerscheinungen bei Gryllus campestris L. ♂, II Mitteilung. *Zool. Anz.*, XXXV, p. 427-432.

RENGEL, C. 1917. . Ein Zwitter von Odynerus callosus Thoms. *S. B. Ges. naturf. Fr. Berlin,* 1917, p. 99-102.

RIDDLE, O. 1916. . Sex control and known correlations in pigeons. *Am. Nat.* L, p. 385-410.

1927. . Review on "The quantitative Theory of Sex." *Science,* LXV, p. 139-141.

ROBSON, G. C. 1911. . The effect of Sacculina upon the fat metabolism of its host. *Quart. Journ. Micro. Sci.,* LVII, p. 267-278.

SALT, G. 1927. . The effects of stylopization on aculeate Hymenoptera. *Journ. Exp. Zool.,* XLVIII, p. 223-319.

SANDHOUSE, G. 1923. . Osmia pentstemonis. *Am. Nat.,* LVII, p. 569.

SCHROTTKY, C. 1913. . As especies brazileiras do Genero Megachile. *Revista do Musai Paulista Sao Paulo,* IX, p. 134-223.

SEXTON, E. W. AND HUXLEY, J. S. 1921. . Intersexes in Gammarus chevreuxi and related forms. *Journ. Marine Biol. Assoc.,* XII, p. 506-556.

SMITH, G. 1905. . Note on a Gregarine, Aggregata inachi n. sp. which may cause the parasitic castration of its host, Inachus dorsettensis. *Mitth. Zool. Stat. zu Neapol.,* XVII, p. 406-410.

1906. . Rhizocephala. *Fauna u. Flora d. Golfes v. Neapol. Berlin,* Monogr. 29.

1910. . Studies in the experimental analysis of sex, part 3. Further observations on parasitic castration. *Quart. Journ. Micro. Sci.,* LV, p. 225-240.

1911. . Studies in the experimental analysis of sex, part 7. Sexual changes in the blood and liver of Carcinus maenus. *Quart. Journ. Micro. Sci.,* LVII, p. 251-265.

1913. . Studies in the experimental analysis of sex, part 10. The effect of Sacculina on the storage of fat and glycogen, and on the formation of pigment by its host. *Quart. Journ. Micro. Sci.,* LIX, p. 267-295.

SMITH, G. AND HAMM, A. H. 1914. . Studies in the experimental analysis of sex, part 11. On Stylops and stylopization. *Quart. Journ. Micro. Sci.* LX, p. 435-461.

SOMEREN, V. G. L. V. 1924. . (footnote). *Journ. E. Afr. & Uganda Nat. Hist. Soc.,* No. 20, p. 15.

STECHE, O. 1912. . Die sekundaren Geschlechtscharaktere der Insekten und das Problem der Vererbung des Geschlechts. *Zeitschr. f. Induct. Abstamm.,* VIII, p. 284-291.

STENTON, R. 1909. . Gynandromorphism of Megachile willughbiella. *Ent. Mag.* XLV, p. 188.

STOCKHERT, F. 1921. . Ueber einem Fall von Frontaler Gynandromorphie bei Bombus lapidarius. *Zeitschr. wiss. Insektenbiol. Berlin,* XVI, p. 132-134.

TROLAND, L. TH. 1917. . Biological enigmas and the theory of enzyme action. *Am. Nat.* LI, p. 321-350.

WHEELER, W. M. 1907..The polymorphism of ants, with an account of some abnormalities due to parasitism. *Bull. Am. Mus. Nat. Hist.*, XXIII, p. 1-93.

1910..The effects of parasitic and other kinds of castration in insects. *Journ. Exp. Zool.*, VIII, p. 377-438.

1915..Gynandromorphous ants. *Am. Nat.* XLVIII, p. 49-56.

1919a..Two gynandromorphous ants. *Psyche*, XXVI, p. 1-9.

1919b..The parasitic aculeata, a study in evolution. *Proc. Am. Phil. Soc.*, LVIII, p. 1-40.

1924..Tetramorium guineense. *Psyche*, XXXI, p. 136-137.

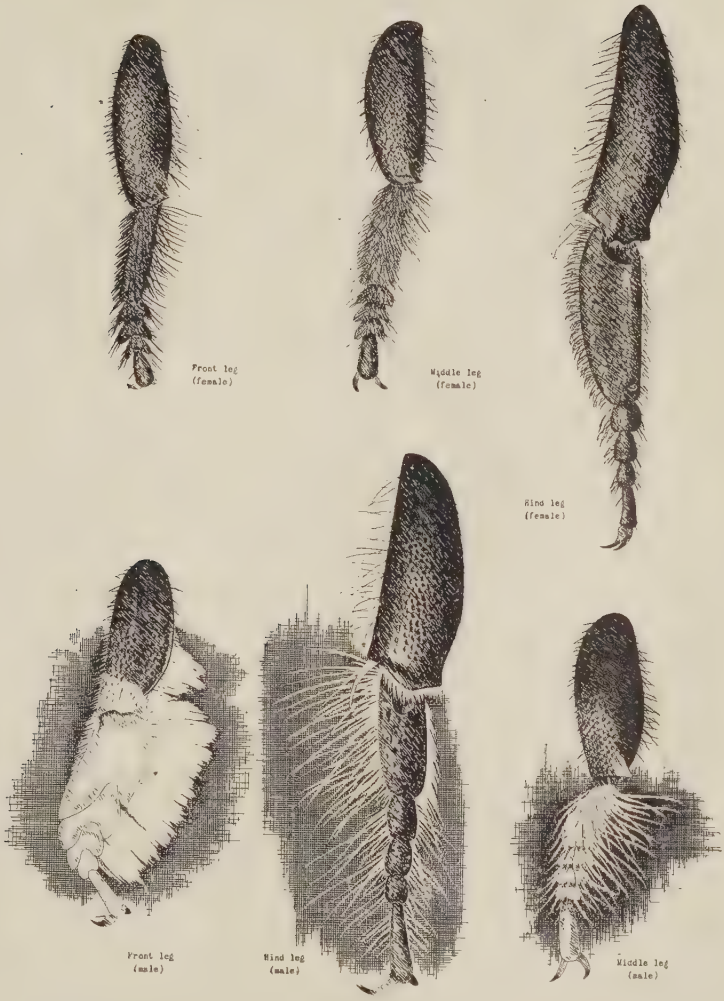
1927..Ants of Lorde Howe Island and Norfolk Island. *Proc. Am. Acad. Arts & Sci.*, LXII, p. 121-153.

WHITING, P. W. 1924..Conflict of instincts in gynandromorphs of Habrobracon. *Am. Soc. Zool. Abstract 140. Anat. Rec.*, XXVI, p. 5.

WHITING, P. W. AND ANNA R. 1927..Gynandromorphs and other irregular types in Habrobracon. *Biol. Bull.*, LII, p. 89-121.

PLATE XXXI

Tibiae and tarsi of *Megachile vidua* Smith



Tibiae and tarsi of Megachile vidua Smith

MITCHELL—SEX ANOMALIES IN MEGACHILE

PLATE XXXII

Antennae of *Megachile vidua* Smith and *parallela* Smith, intersexes; tarsi of *Megachile tapytensis, chapadiana* and *dilatata* new species

Apices of antennae of M.vidua (intersex #1)

Apices of antennae of M.vidua (intersex #2)

Front tarsus of Megachile sp. (intersex)

Front tarsus of M.tapytensis (male)

Front tarsus of M.chapadiana (male)

Mid tibia of M.chapadiana (male)

Mid tibia of M.chapadiana (female)

Front tarsus of M.chapadiana (female)

Apex of antenna of M.dilatata

Front tarsus of M.dilatata

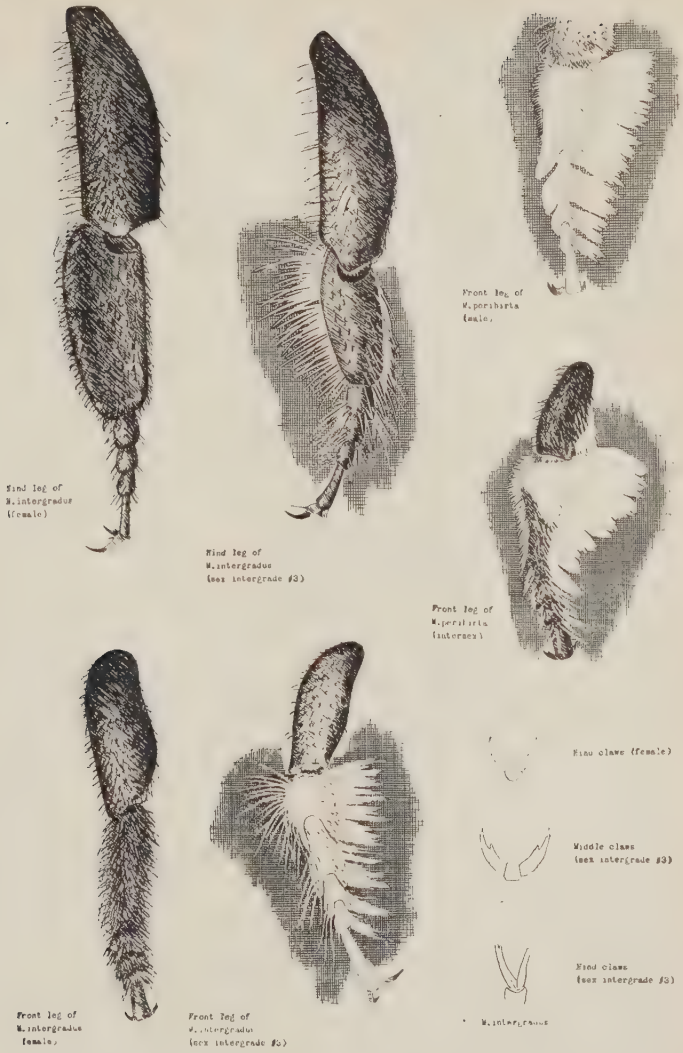
Dentition of mandible of M.dilatata

Apices of antennae of M.parallela (intersex)

MITCHELL—SEX ANOMALIES IN MEGACHILE

PLATE XXXIII

Tarsi of *Megachile perihirta* Cockerell and *intergradus* new species



MITCHELL—SEX ANOMALIES IN MEGACHILE

PLATE XXXIV

Fig. 1..*Megachile vidua* Smith. Male. X 3
Fig. 2..*Megachile vidua* Smith. Female. X 3
Fig. 3..*Megachile vidua* Smith. Intersex 1. X 3
Fig. 4..*Megachile vidua*. Smith. Intersex 2. X 3

MITCHELL—SEX ANOMALIES IN MEGACHILE

PLATE XXXV

Fig. 1. *Megachile gemula* Cresson. Intersex. X 3

Fig. 2. *Megachile parallela* Smith. Intersex. X 3

Fig. 3. *Megachile perihirta* Cockerell. Intersex. X 3

Fig. 4. *Megachile dilatata* new species. X 3

MITCHELL—SEX ANOMALIES IN MEGACHILE

PLATE XXXVI

Fig. 1. . *Megachile chapadiana* new species. Male. X 3

Fig. 2. . *Megachile chapadiana* new species. Gynandromorphic female. X 3

Fig. 3. . *Megachile tapytensis* new species. Normal male.

Fig. 4. . *Megachile tapytensis* new species. Intersex. X 3

MITCHELL—SEX ANOMALIES IN MEGACHILE

PLATE XXXVII

Fig. 1..*Megachile uniformis* new species. Male. X 5

Fig. 2..*Megachile uniformis.* new species. Female. X 5

Fig. 3..*Megachile bertonii* Schrottky. Intersex. X 5

Fig. 4..*Megachile* sp. Intersex. X 5

MITCHELL—SEX ANOMALIES IN MEGACHILE

New names are followed by the name of the author within parentheses ( ). Bold face numbers denote that the genus or species is particularly discussed on that page. An asterisk (*) denotes that a figure is referred to on that page. Names and pages in *italics* refer to synonyms.

PAGE

abbreviatus, Symphyloxiphus .. 258
abdominalis, Ospriocerus, *Asilus* **301***
acanthoptera, Eugryllina (Hebard) **88***
Acheta (*see* asimilis)
Acla (Hebard) **91**
(*see also* crassicornis)
Alcodes (Hebard) **94**, 244
(*see also* maculatum, nicusea)
aemona, Homoptera *216*
aeneola, Haltica **57**
aenescens, Haltica *57*
aequatorialis, Paratropes 157
aeruginosa, Zale, *Ypsia, Phaeocyma* **224**
agassizi, Scapteriscus 122
albifrons, Amusodes (Hebard) . **48***
albipalpus, Hygronemobius ... 245
albosquamulata, Zale *225*
albidula, Zale, *Homoptera* **224**
albofasciata, Homoptera *226*
alcione, Campsomeris, *Trielis* *202*, **212***
aldrichii, Promachus **316**
Amblyrethus (*see* brevipes, ponderosus)
Amphiacusta (*see* annulipes, phalangium)
americana, Chopardina, *Metioche* **260**
Anisopogon (*see* ludius)
amoenus, Hygronemobius 242
amoenus, Phylloscyrtus 104
Amusina (Hebard) **30**
(*see also* kraussi)
Amusodes (Hebard) **48**
(*see also* albifrons, andeanum, estrellae, festae)

PAGE

Amusus *43*
(*see also* bolivianus, festae, kirschianus, kraussi, mexicanus)
Anacusta (Hebard) **54**
(*see also* micans)
Anaxipha (*see* annulipes, championi, fistulator, fragilis, gracilis, hirsuta, minuta, nitida, platyptera, pulicaria, stolzmannii, stramenticia, tolteca, variegata)
andeana, Phortioeca (Rehn) ..**165***
andeanum, Amusodes (Hebard) **51**
Aneoptera (*see* aztecus)
angusticollis, Cyrtoxipha 255
annulatum, Cycloptillum (Hebard) **114***, 284
annulatus, Paroecanthus, *Eneoptera* **108**, 271
annuliger, Luzarida (Hebard) **39***, **85**
annuliger, Quarequa (Hebard) .**245***
annulipes, Amphiacusta 250
annulipes, Anaxipha 101
Anthracia (*see* coracias)
antillarum, Cycloptilum, *Ectatoderus* **113**, **284**
Anurogryllus (*see* muticus)
Aphemogryllus (*see* gracilis)
Aphonomorphus 109, **277**
(*see also* bicolor, conspersus, flavifrons, griseus, hapithefrons, mutus, obliquus, pusillus, silens, tenebrosus, tumidus)
Aphonus (*see* flavifrons, macilentus, peruvianus, tumidus)

apicialis, Tridactylus **290**
apolinari, Phortiocca 165
apterus, Endacustes *93*
Argizala (*see* brasiliensis)
Arthmius (*see* delicatus, elegantulus, laevipennis, magnus)
Asilidae, Genitalia of.....**298***
Asilidae, Morphology of **298***
Asilus (*see* abdominalis, auriannulatus, interruptus, lecythus, tenebrosus)
assimilis, Gryllus, *Acheta*....81, **239**
atritincta, Homoptera *224*
atropos, Euphyllodromia (Rehn) **137***
Audreia 169
(*see also* marginata)
aurantiaca, Pseudomops 153
auriannulatus, Asilus **318***
australis, Zale **227**
aztecus, Aneoptera 271
aztecus, Endacustes 91

barbatus, Erax, *Dasypogon* ...**309***
bastardii, Promachus, *Trupanea* **314***
belfragei, Trigonidomimus 244
bellus, Hamotus 77
benesignata, Zale, *Homoptera, Phaeocyma* **228***
bertoni, Megachile.....**335***
bethunei, Zale, *Phaeocyma* **229**
bicolor, Aphonomorphus (Hebard) **279***
bicolor, Chaetocnema (Gentner) **63**
bigoti, Deromyia, *Sarcopogon*..**307***
biloba, Ripipteryx (Hebard)...**292***
biolleyi, Litopeltis, *Calolampra*.**179***
bipunctata, Neoxabea ..98, 100, 235
bispinosa, Litopeltis, *Calolampra* **171***
blatchleyi, Safia (Haimbach)..**231***
bolivianus, Amusus *38*
boliviana, Palpigera, *Luzara*... **37***
boliviensis, Euphyllodromia, *Pseudophyllodromia* **145***
borelli, Palpigera, *Ectecous, Prosthacusta* **38***
brasiliensis, Nemobius, *Argizala* **243**
brevipes, Amblyrhethus 273
brisleyi, Haltica (Gentner).... **59**
brunnerianus, Phyllopalpus 104

caeruleus, Phyllopalus 104
californiae, Stenopogon, *Dasypogon* **304***
californicus, Oecanthus **250**
callizona, Dendroblatta (Rehn) **126***
Calolampra (*see* biolleyi, bispinosa)
calverti, Litopeltis (Rehn)....**174***
calycanthata, Phaeocyma *223*
calycanthata, Zale, *Phalena*.... **230**
camerani, Scapteriscus *121*
Campsomeris **195**
(*see also* alcione, flammicoma, hermione, lugens, octomaculata, plumipes, pollenifera, texensis, xantiana)
canotus, Cranistus 104
cantans, Ectecous 92
capucina, Cariacasia (Rehn)...**191***
carbonaria, Ripipteryx **123**, 236
Cariacasia (Rehn) **190**
(*see also* capucina)
caribbea, Paracophella (Hebard) **24***
Cariblatta 135
(*see also* cryptobia, cuprea, reticulosa)
casenare, Megalamusus (Hebard) **53*, 86**
cayennensis, Orocharis 108, 236, 274
Chaetocnema (*see* bicolor, magnipunctata, obesula, parvula)
championi Anaxipha, *Cyrtoxiphus* **254**
championi, Diatrypa **269**
chapadiana, Megachile (Mitchell) **346***
choco, Gryllosoma (Hebard) **26*, 84**
Chopardina (Hebard) **260**
(*see also* americana)
Chrysomelidae **57**

cicindeloides, Phylloscyrtus 103, 261
cinerea, Homoptera *225*
cingulifera, Zale, *Homoptera, Phaeocyma* **230**
circumcincta, Prosthacusta, *Nemobius* **20**
Colapteroblatta 169
colliurides, Cranistus 104
colorado, Zale, *Phaeocyma*..... **230**
configurata, Zale, *Homoptera*.. **218**
consanguineus, Stenopogon **303***
consors, Scolia *203*
conspersus, Aphonomorphus ... 111
convolutus, Miogryllus, *Gryllus* **239***
Cophella (Hebard) **21**
(*see also* formosa, rehni, picta)
cophus, Paraphonus (Hebard).**111***
coracias, Zale, *Anthracia*..... **225**
corrugata, Laurepa 236
corvus, Zale, *Pseudanthracia*... **225**
costatus, Phylloscirtus *104*
Cranistus 104
(*see also* canotus, colliurides, macilentus, similis)
crassicornis, Acla, *Heterogryllus* 93, **249**
crocinus, Podoscirtus 275
cryptobia, Cariblatta 24
cubensis, Nemobius (Neonemobius) **243**
cuprea, Cariblatta 24
curema, Phaeocyma, Zale..... *228*
Cycloptillum (*see* annulatum, antillarum, lepismoide, medium, scotops, thoracicum, zebra)
Cyrtoxipha (*see* angusticollis, championi, gracilis, granadensis, gundlachi, macilenta, pictus, stolzmanni, tolteca)

darienicus, Endacustes *93*
darienicus, Hygronemobius (Hebard) **242***
Dasylis (*see* fernaldi)
Dasypogon (*see* barbatus, californiae)
dealbata, Zale *231*
Decarthron (*see* lamellipes)
declarens, Zale, *Homoptera*.... **223**
deianira, Litopeltis (Rehn)....**186***
delicatus, Arthmius (Fletcher) **70**
Dendroblatta (*see* callizona, insignis, sobrina)
denticulatus, Tridactylus 288
Deromyia (*see* bigoti)
Diatrypa (*see* championi, jansoni, pallidelabris, tolteca, univittata)
didactylus, Scapteriscus, *Gryllotalpa* **120**, 122, **287**
digitatus, Tridactylus 287
dilatata, Megachile (Mitchell) **344***
Diplacusta (*see* fuscipennis, inalata)
discisigna, Zale, *Homoptera*.... **216**
discisignata, Zale *216*
dispar, Endacustes 92, 94
dukinfieldia, Homoptera *225*
duplicata, Zale, *Homoptera, Phaeocyma*..... **229**

Ectatoderus (*see* antillarum)
Ectecous 269
(*see also* borelli, cantans, hedyphonus)
edusa, Noctua *219*
edusina, Zale *Homoptera, Phaeocyma* **224**
edusinoides, Zale *224*
elegans, Euphyllodromia, *Pseudophyllodromia* **136***, 139
elegans, Paraeniopterus *262*
elegans, Phylloscyrtus **104**, **261**
elegantulus, Arthmius (Fletcher) **69**
Elis (*see* lugens, lupina, pollenifera, texensis, xantiana, zonaria)
Ellipes *287*
Endacusta 91
(*see also* apterus, aztecus, darienicus, dispar, irrorata, maculatum)
Endecous 91

Encoptera (*see* annulatus, surinamensis)
ensifer, Miogryllus, *Nemobius*. 240
Epilampra 135
Erax (*see* barbatus, interruptus, stamineus, subpilosus)
Erebus (*see* putrescens)
erno, Proctacanthus 309*
erro, Longitarsus 65
esau, Gryllosoma (Hebard) 25*, 84, 248
estrellae, Amusodes (Hebard).. 49
Euaphonus (Hebard) ..... 109 (*see also* peruvianus)
Eugryllina (Hebard) .....86, 244 (*see also* acanthoptera, veraquae)
Eunyctibora 157
Euphyllodromia (*see* atropos, boliviensis, elegans, jugata, nigrochlamys, tupi)
Euscyrtus (*see* mexicanus)
Eustegasta 135
Eushelfordia 157
excellens, Zale, *Homoptera* 226
exhausta, Zale, *Homoptera, Phaeocyma* 216

femoralis, Reichenbachia (Fletcher) 74
fernaldi, Dasylis 306*
festae, Amusodes, *Amusus* 31, 86, 248
festae, Amusodes, *Amusus*.... 51*
fictilis, Zale, *Homoptera, Phaeocyma* 218
fictor, Nyctibora (Rehn).....159*
fistulator, Anaxipha *254*
flammicoma Campsomeris (Bradley) 209*
flavifrons, Aphonomorphus, *Aphonus* 279
flavosignata, Scolia *203*
fluctuaris, Noctua *219*
foliacea, Haltica 58
forceps, Ripipteryx 124
formosa, Cophella (Hebard)... 23*
forticeps, Parametrypa 110
fratercula, Palpigera (Hebard) 36*
fragilis, Anaxipha 254
fuliginosa, Zale, *Homoptera*... 218
fulviventris, Mallophora 313*
funebris, Lerneca (Hebard)... 16*
fuscipennis, Lerneca, *Diplacusta* 16

galactea, Zale 217
galbanata, Zale, *Homoptera*... 224
gemula, Megachile 333*
glaphyra, Rehniella (Hebard). 31*
gracilior, Luzarida (Hebard).. 42*
gracilis, Anaxipha, *Trigonidium* 254, 101
gracilis, Aphemogryllus 244
gracilis, Cyrtoxipha 256
gracillimus, Stenoecanthus 282
gradata, Homoptera *218*
granadensis, Cyrtoxipha *256*
grata, Pseudomops 153
grata, Zale 218
griseus, Aphonomorphus 282
Gryllidae 79, 233
Gryllodes (*see* sigillatus, subapterus)
Gryllosoma (Hebard) ..... 25 (*see also* choco, esau)
Gryllotalpa (*see* didactylus, hexadactyla, intermedia, tetradactylus)
Gryllus (*see* assimilis, mexicanus, convoltus, pulicaria, sigillatus, surinamensis, verticalis)
guadulpennis, Homoptera *218*
guildiana, Mallophora 313*
gundlachi, Cyrtoxipha 259
gundlachi, Nemobiopsis 244

Haltica (*see* aeneola, aenescens, brisleyi, foliacea, nigra)
Hamotus (*see* bellus)
hapitheformis, Aphonomorphus. 282
Hapithoides (Hebard) ..... 269 (*see also* insolitum)
Hapithus ..... 269 (*see also* montanus)
hedyphonus, Ectacous 92
helata, Zale, *Phaeocyma*..... 229
Hemigryllus (*see* ortonii)

hercules, Ischnoptera (Rehn) . . **130***
hermione, Campsomeris, *Trielis* **205***
hesperus, Paroecanthus 272
Heterogryllus (*see* crassicornis)
Heteropogon (*see* ludius)
hexadactyla, Gryllotalpa . . . **122, 287**
hirsuta, Anaxipha (Hebard) . . . **252**
hirsutus, Phyllogryllus (Hebard) **265***
histrio Tridactylus 292
Homoptera (*see* aemona, albidula, albofasciata, atritincta, benesignata, cinerea, cingulifera, configurata, declarens, discisigna, dunkinfieldia, duplicata, edusina, excellens, exhausta, fictilis, fuliginosa, galbanata, gradata, guadulpennis, intenta, involuta, janisca, lineosa, marginalis, minerea, nigricans, obliqua, penna, perpuncta, plenipennis, posterior, privata, rosae, rubi, sabena, salicis, saundersi, sexplagiata, strigimacula, terrosa, umbripennis, uniformis, unilineata, ustipennis, vernifera, viridans, viridisquama, woodi)
horrida, Zale, *Phaeocyma* **231**
hydromeda, Ripipteryx 236
Hygronemobius 244
(*see also* albipalpus, amoenus, darienicusfi liura)

inalata, Lerneca, *Diplacusta* . . . **20**
incipiens, Letis *216*
inflatipalpus, Pseudohamotus . . **77**
inflatus, Tridactylus 287
insignis, Dendroblatta 126
insolitum, Hapithoides (Hebard) **270***
insuda, Zale, *Phaeocyma* **226**
intenta, Homoptera *230*
intercepta, Pseudomops 150
intergradus, Megachile (Mitchell) **339***
intermedia, Gryllotalpa 236
intermedius, Phylloscyrtus (Hebard) **105***
interruptus, Erax, *Asilus* **310***
intricata, Neoxabea (Hebard) . **99***
involuta, Homoptera *226*
irrorata, Endacusta 91
Ischnoptera (*see* hercules)

janisca, Zale, *Homoptera* **225**
jansoni, Diatrypa **267**
japonicus, Tridactylus 287
jugata, Euphyllodromia **143***

kirschianus, Amusus *44, 51, 87*
kirschianus, Luzara 234
kraussi, Amusina, *Amusus* **31**
kriechbaumeri, Nemobius *84*

laevigata, Nyctibora 159
laevipennis Arthmius (Fletcher) **72**
lamellipes, Decarthron (Fletcher) **76**
lapidaria, Zale (Haimbach) . . . **228**
largera, Zale *228*
latifrons, Orocharis **108, 274**
latipennis, Orocharis 108
Laurepa (*see* corrugata, musica)
lecythus, Asilus **316***
lepismoide, Cycloptilum 285
Lerneca **3, 247**
(*see also* funebris, fuscipennis, inalata, varipes)
Lernecella (Hebard) **13**
(*see also* trinitatis)
Letis (*see* incipiens)
Leurolestes 169
limbata, Ripipteryx 236
limpida, Reichenbachia (Fletcher) **75**
lineosa, Homoptera, Phaeocyma *226*
Litopeltis **168**
(*see also* biolleyi, bispinosa, calverti, deianira, musarum, oreas, votos)
liura, Hygronemobius **242**
lizeri, Schistopeltis (Rehn) **162***

Longitarsus (*see* erro, menthaphagus, suspectus, testaceus)
ludius, Heteropogon, *Anisopogon* 305*
lugens, Campsomeris, *Elis*..... 214
lunata, Zale, *Noctua, Phaeocyma* 219
lunatoides, Zale 221*
lunifera, Zale, *Phaeocyma*..... 226
lupina, Elis *203*
lurida, Tafalisca 110
Luzara 43
(*see also* boliviana, kirschianus, minor, rufipennis)
Luzarida (Hebard) 39
(*see also* annuliger, gracilior, pulla)

macilentus, Cranistus 104
macilenta, Macroanaxipha, *Cyrtoxiphus* 256*
macilentus, Stenaphonus, *Aphonus* 110, 284
Macroanaxipha (Hebard) 256
(*see also* macilenta)
maculatum, Aclodes, *Endacusta* 92, 96*
magnificus, Symphyloxiphus ... 257
magnipunctata, Chaetocnema... 64
magnus, Arthmius (Fletcher).. 73
Mallophaga (*see* fulviventris, guildiana)
marginalis, Homoptera *220*
marginata, Audreia *171*
martinii, Paragryllus 234
maxillaris, Orocharis 236
maximiliani, Phortioeca 165
medium, Cyclóptilum (Hebard) 284*
Megalamusus (Hebard) 53
(*see also* casenare)
Megachile, Sex anomalies 321
(*see also* bertoni, chapadiana, dilatata, gemula, intergradus, parallela, perihirta, tapytensis, uniformis, vidua)
menthaphagus, Longitarsus ... 65
meridiana, Zale (Haimbach)... 217
metata, Zale, *Phaeocyma*.....228*
Metioche (*see* americana)
Metrypa *110*
mexicanus, Amusus 6, 13, *31*
mexicanus, Euscyrtus 275
mexicanus, Gryllus *239*
mexicana, Prosthacusta *20*
mexicana, Zale (Haimbach)... 222
micans, Anacusta (Hebard).54*, 86
milbertii, Proctacanthus 308*
minerea, Zale, *Homoptera, Phaeocyma* 226
minereana, Zale *226*
minerella, Zale *226*
minereoides, Zale *226*
minor, Luzara (Hebard)....46*, 85
minuta, Anaxipha 235, 254
minutus, Tridactylus 288*
Mioblatta 169, 190
Miogryllodes (Hebard) 14
modestus, Stenopogon 302*
montanus, Hapithus 235
montanus, Thamnoscirtus *104*
mormonius, Nemobius 243
mortuifolia, Phyllogryllus *266*
musarum, Litopeltis (Rehn)...172*
musica, Laurepa 236
muticus, Anurogryllus, Gryllus 82, 241
mutus, Aphonomorphus ...109, 277
Myogryllus (*see* convolutus, ensifer, panamae, verticalis)
Myzine 206

Nemobiopsis (*see* gundlàchi)
Nemobius (*see* brasiliensis, circumcincta, cubensis, ensifer, kriechbaumeri, mormonius, ortonii)
Neonemobius (*see* cubensis)
Neoxabea (*see* bipunctata, intricata, trinodosa)
nicuesa, Aclodes (Hebard) 95*, 249
niger, Odontogryllus *83*
nigra, Haltica (Gentner)..... 61
nigrellus, Symphyloxiphus (Hebard) 257*, 258

nigricans, *Homoptera* 225
nigrior, Zale *224*
nigripes, Promachus 315*
nigrochlamys, Euphyllodromia (Rehn) 146*
nimbata, Phortioeca 165
Niquirana (Hebard) 29
(*see also* polita)
nitida, Anaxipha 101, 245, 255
Noctua (*see* edusa, fluctuaris, lunata, squamularis, undularis)
norda, Phaeocyma *226*
Nyctibora (*see* ficator, laevigata, sericea)

obesula, Chaetocnema 63
obliqua, Homoptera, Phaeocyma, Zale *227*
obliquus, Aphonomorphus 281
octomaculata, Campsomeris, *Scolia* 201*, 202
Odontogryllus (*see* niger, setosus)
Oecanthus (*see* californicus, peruvianus, varicornis)
oreas, Litopeltis (Rehn).....181*
Orocharis (*see* cayennensis, latifrons, latipennis, maxillaris, tibialis)
orocharoides, Podoscirtus (Hebard) 275*
ortonii, Hemigryllus, *Nemobius* 84
Ospriocerus (*see* abdominalis)
Oxathrius (*see* simplex)

pachystrigata, Zale 216
pallidelabris, Diatrypa 267, 235
Palpigera (Hebard) 36
(*see also* boliviana, fratercula, borelli)
panamae, Miogryllodes (Hebard) 15*
Paracophella (Hebard) 24
(*see also* caribbea)
Paraeniopterus (*see* elegans)
Paragryllus 249
(*see also* martinii, temulentus)
parallela, Megachile 333*
Paraphonus (Hebard) 111
(*see also* cophus)
Paratropes 135
(*see also* aequatorialis, pensa)
Parametrypa (*see* forticeps)
Paroecanthus 109
(*see also* annulatus, hesperus, picipes, podagrosus, roosevelti, tibialis, vivinus)
parvula, Chaetocnema (Gentner) 62
peculiaris, Schistopeltis 162
penna, Zale, *Homoptera*..... 227
pensa, Paratropes (Rehn).....157*
Pentacentrinae 244
Pentacentrus 244
perihirta, Megachile 334*
peruana, Phortioeca 165
peruncta, Homoptera *216*
peruvianus, Aphonus 277
peruvianus, Euaphonus 109
peruvianus, Oecanthus 98
Phaeocyma (*see* aeruginosa, benesignata, bethunei, calycanthata, cingulifera, colorado, curema, duplicata, edusina, exhausta, fictilis, helata, horrida, insuda, lineosa, lunata, lunifera, metata, minerea, norda, obliqua, rubi, rubiata, salicis, squamularis, termina, undularis, unilineata, viridans, yavapai)
phaeograpta, Zale 221
phalangium, Amphiacusta 249
Phalangopsinae 1
Phalena (*see* calycanthata)
phoraspoides, Phortioeca 165
Phortioeca (*see* andeana, apolinari, maximiliani, nimbata, peruana, phoraspoides)
Phyllogryllus (*see* hirsuts, mormortuifolia, velutinus)
Phyllopalpus 104

(*see also* brunnerianus, caeruleus, pulchellus)
Phylloscyrtus 103
(*see also* amoenus, cicindeloides, costatus, elegans, intermedius, trinotatus, viridicatus, vittatus)
picipes, Paroecanthus *272*
picta, Cophella (Hebard)..... 22*
pictus, Symphyloxiphus, *Cyrtoxiphus* 257
Platydactylus (*see* vicinus)
platyptera, Anaxipha (Hebard) 101*, 255
plenipennis, Homoptera *224*
plumbeolineata, Zale 221
plumbimargo, Zale 221
plumipes, Campsomeris 206
podagrosus, Paroecanthus 272
Podoscirtus (*see* crocinus, orocharoides)
polita, Niquirana (Hebard)... 29*
pollenifera, Campsomeris, *Elis* 208*
Ponca (Hebard) 262
(*see also* venosa)
ponderosus, Amblyrhethus (Hebard) 273*
posterior, Zale, Homoptera.... 219
postmedialis, Zale *216*
praeclara Pseudomops (Rehn) .150*
privata, Homoptera *216*
Proctacanthus (*see* erno, milbertii)
Promachus (*see* aldrichii, bastardii, nigripes)
Prosthacusta (*see* circumcincta, mexicana, borelli)
Prosthama (Hebard) 34
(*see also* tessellata)
Pselaphidae 69
Pseudanthracia (*see* corvus)
Pseudohamotus (*see* inflatipalpus)
Pseudomops (*see* aurantiaca, grata, intercepta, praeclara, zonata)
Pseudophyllodromia (*see* boliviensis, elegans)
Pseudotrielis 196
pulchellus, Phyllopalpus 104
pulchella, Tairona (Hebard) 27*, 84
pulex, Symphyloxiphus 258
pulex, Tridactylus 287
pulicaria, Anaxipha, *Gryllus*.. 251
pulicaria, Ripipteryx 122, 291
pulla, Luzarida (Hebard)...41*, 85
purpureo-brunnea, Zale *223*
pusillus, Aphonomorphus (Hebard) 282*
putrescens, Erebus *220*
Pycnoscelus (*see* surinamensis)

Quarequa (Hebard) 245
(*see also* annuliger)

regina, Scolia *203*
rehni, Cophella (Hebard) 21*
Rehniella (Hebard) 31
(*see also* glaphyra)
Reichenbachia (*see* femoralis, limpida)
reticulosa, Cariblatta 24
rhigodora, Zale 228
Ripipteryx (*see* biloba, carbonaria, forceps, hydromeda, limbata, pulicaria, rivularia)
rivularia, Ripipteryx 294
roosevelti, Paroecanthus 272
rosae, Homoptera *219*
rostratus, Tridactylus (Hebard) 289*
rubi, Zale, *Homoptera, Phaeocyma* 230
rubiata, Zale, *Phaeocyma*..... 230
rufipennis, Luzara 44*, 85, 87, 248
rufosa, Zale 219

sabena, Zale, *Homoptera*..... 218
Safia (*see* blatchleyi)
salicis, Zale, *Homoptera, Phaeocyma* 219
Sarcopogon (*see* bigoti)
saundersi, Homoptera *220*
savignyi, Tridactylus 287

Scapteriscus (*see* agassizi, camerani, didactylus, tetradactylus, vicinus)
Schistopeltis (*see* lizeri, peculiaris)
Scolia 196
(*see also* consors, flavosignata, octomaculata, regina)
Scoliidae 195
scotops, Cycloptillum (Hebard) **116***, 284
sericea, Nyctibora 159
setipes, Zale, *Xylis* **216**
setosus, Odontogryllus 46, **83**
sexplagiata, Zale, *Homoptera*.. **219**
sigillatus, Gryllodes, *Gryllus*... **240**
silens, Aphonomorphus 111
similis, Cranistus 104
simplex, Oxathrius *74*
smithi, Zale (Haimbach).....**221***
sobrina, Dendroblatta 126
squamularis, Zale, *Noctua, Phaeocyma* **227***
stamineus, Erax **311***
Stenaphonus 110
(*see also* macilentus)
Stenoecanthus (*see* gracillimus)
Stenopogon (*see* californiae, consanguineus, modestus)
stolzmannii, Anaxipha, *Cyrtoxiphus* **101, 251**
stramenticia, Anaxipha 254, 256
strigimacula, Homoptera *218*
subapterus, Gryllodes *240*
subpilosus, Erax **312**
surinamensis, Eneoptera, *Gryllus* **108, 262**
surinamensis, Pycnoscelus 181
suspectus, Longitarsus **65**
Symphyloxiphus (*see* abbreviatus, maginificus, nigrellus, pictus, pulex)

Tafalisca 110
(*see also* lurida)
Tairona (Hebard) **27**
(*see also* pulchella)
tapytensis, Megachile (Mitchell) **335***
tartarus, Tridactylus 287
temulentus, Paragryllus 234
tenebrosus, Aphonomorphus (Hebard) **277***
tenebrosus, Asilus **317***
termina, Zale, *Phaeocyma*..... 230
terrosa, Zale, *Homoptera* **218**
tessellata, Prosthama (Hebard) **34***, **243**
testaceus, Longitarsus **66**
tetradactylus, Scapteriscus, *Gryllotalpa* **121**
texensis, Compsomeris, *Elis*....**203***
Thamnoscirtus *103*
(*see also* montnus)
thoracicum, Cycloptillum (Hebard) **117***
thoracicus, Tridactylus 288
tibialis, Orocharis 274, 235
tibialis, Paroecanthus 235
tolteca, Anaxipha, *Cyrtoxipha*.. **254**
tolteca, Diatrypa 267
Tridactylus **287**
(*see also* apicalis, denticulatus, digitatus, histrio, inflatus, japonicus, minutus, pulex, rostratus, savignyi, tartarus, thoracicus, variegatus)
Trielis 195
(*see also* alcione, hermione)
Trigonidium (*see* gracilis)
Trigonidomimus (*see* belfraegi)
trinitatis, Lernecella (Hebard) **13***
trinodosa, Neoxabea **98***
trinotatus, Phylloscyrtus (Hebard) **107***
Trupanea (*see* bastardii)
tumidus, Aphonomorphus, *Aphonus* **110**, 277
tupi, Euphyllodromia (Rehn)..**139***

umbripennis, Zale, *Homoptera*. **225**
undularis, Zale, *Noctua, Phaeocyma* **225**
uniformis, Homoptera *231*
uniformis, Megachile (Mitchell) **349***

unilineata, Zale, *Homoptera, Phaeocyma* **223**
univittata, Diatrypa (Hebard) . **267***
ustipennis, Homoptera *216*

varicornis, Oecanthus 98, **250**
variegata, Anaxipha 101
variegatus, Tridactylus 287
varipes, Lerneca **17***
velutinus, Phyllogryllus 266
venosa, Ponca (Hebard) **263***
veraguae, Eugryllina (Hebard) **89***, **249**
vernifera, Homoptera *216*
verticalis, Miogryllus, *Gryllus* **82**, 234
vicinus, Platydactylus *262*
vicinus, Scapteriscus **122**, 236
vidua, Megachile **332***
viridans, Zale, *Homoptera, Phaeocyma* **217**
viridicatus, Phylloscyrtus 104
viridisquama, Homoptera *217*
vittatus, Phylloscyrtus 104
vivinus, Paroecanthus *272*
votos, Litopeltis (Rehn) **177***

woodi, Homoptera *230*

xantiana, Campsomeris, *Elis*... **207**
Xylis (*see* setipes)

yavapai, Phaeocyma, Zale..... *230*
Ypsia (*see* aeruginosa)

Zale (*see* aeruginosa, albosquamulata, albidula, australis, benesignata, bethunei, calycanthata, cingulifera, colorado, configurata, coracias, corvus, curema, dealbata, declarens, discisigna, discisignata, duplicata, edusina, edusinoides, excellens, exhausta, fictilis, fuliginosa, galactea, galbanata, grata, helata, horrida, insuda, janisca, lapidaria, largera, lunata, lunatoides, lunifera, meridiana, metata, mexicana, minerea, minereana, minerella, minereoides, nigrior, obliqua, pachystrigata, penna, phaeograpta, plumbeolineata, plumbimargo, posterior, postmedialis, purpureobrunnea, rhigodora, rubi, rubiata, rufosa, sabena, salicis, setipes, sexplagiata, smithi, squamularis, termina, terrosa, umbripennis, undularis, unilineata, viridans, yavapai, zana, zanata)
zana, Zale *219*
zanata, Zale *219*
zebra, Cycloptillum 117
zonaria, Elis *203*
zonata, Pseudomops (Rehn)... **153***

VOLUME LIV NUMBER 1

MARCH, 1928

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT

THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
R. C. Williams, Jr.

VICE-PRESIDENT
Philip Laurent

CORRESPONDING SECRETARY
James A. G. Rehn

RECORDING SECRETARY
R. J. Titherington

TREASURER
E. T. Cresson, Jr.

LIBRARIAN
E. T. Cresson, Jr.

CURATOR
Louise Knobel

FINANCE COMMITTEE
Morgan Hebard
Chairman
Philip Laurent
W. J. Coxey

PUBLICATION COMMITTEE
James A. G. Rehn
Chairman
P. P. Calvert
Morgan Hebard
E. T. Cresson, Jr.
Editor

LIBRARY COMMITTEE
Frank M. Jones
Chairman
R. G. Schmieder
Henry Fox

Meetings held on the fourth Thursday of January, February, March, April, May, September, and October; and on third Thursday of November and December. The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Acadamy of Natural Sciences of Philadelphia.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of The Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of The American Entomological Society, volumes I–IV, out of print and cannot be supplied; V—date, price on application. Published in annual volumes of quarterly parts. Subscription price $5.00 per volume.

The Practical Entomologist, volumes I-II, 1865-1867. Price, $4.00 for the two volumes.

Memoirs of The American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50. Published irregularly.

Entomological News, volumes I-XXXIX; many out of print. Subscription price $3.00 per annual volume.

Various irregular, non-serial publications have been issued, which may be found in our price list under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
Academy of Natural Sciences,
Logan Square, Philadelphia, Pa.

CONTENTS

The Group Luzarae (Orthoptera: Gryllidae). By Morgan Hebard 1

(Issued April 30, 1928)

VOLUME LIV NUMBER 2

JULY, 1928

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT

THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
R. C. Williams, Jr.

VICE-PRESIDENT
Philip Laurent

CORRESPONDING SECRETARY
James A. G. Rehn

RECORDING SECRETARY
R. J. Titherington

TREASURER
E. T. Cresson, Jr.

LIBRARIAN
E. T. Cresson, Jr.

CURATOR
Louise Knobel

FINANCE COMMITTEE
Morgan Hebard
Chairman
Philip Laurent
W. J. Coxey

PUBLICATION COMMITTEE
James A. G. Rehn
Chairman
P. P. Calvert
Morgan Hebard
E. T. Cresson, Jr.
Editor

LIBRARY COMMITTEE
Frank M. Jones
Chairman
R. G. Schmieder
Henry Fox

Meetings held on the fourth Thursday of January, February, March, April, May, September, and October; and on third Thursday of November and December. The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Acadamy of Natural Sciences of Philadelphia.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of The Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of The American Entomological Society, volumes I–IV, out of print and cannot be supplied; V—date, price on application. Published in annual volumes of quarterly parts. Subscription price $5.00 per volume.

The Practical Entomologist, volumes I-II, 1865-1867. Price, $4.00 for the two volumes.

Memoirs of The American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50. Published irregularly.

Entomological News, volumes I-XXXIX; many out of print. Subscription price $3.00 per annual volume.

Various irregular, non-serial publications have been issued, which may be found in our price list under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
Academy of Natural Sciences,
Logan Square, Philadelphia, Pa.

CONTENTS

Contributions to our Knowledge of North American Halticinae. 1. Notes, with Descriptions of New Species. (Coleoptera: Chrysomelidae). By L. G. Gentner . 57
(Issued May 16, 1928)

The Cornell University Entomological Expedition to South America, 1919–1920. Scientific Results, No. 4: Pselaphidae. (Coleoptera). By Frank C. Fletcher . . 69
(Issued May 16, 1928)

Studies in the Dermaptera and Orthoptera of Colombia. Fifth Paper. Orthopterous Family Gryllidae. By Morgan Hebard 79
(Issued June 12, 1928)

New or Little Known Neotropical Blattidae. (Orthoptera). No. 1. By James A. G. Rehn 125
(Issued July 19, 1928)

VOLUME LIV NUMBER 3

SEPTEMBER, 1928

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT

THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
R. C. Williams, Jr.

VICE-PRESIDENT
Philip Laurent

CORRESPONDING SECRETARY
James A. G. Rehn

RECORDING SECRETARY
R. J. Titherington

TREASURER
E. T. Cresson, Jr.

LIBRARIAN
E. T. Cresson, Jr.

CURATOR
Louise Knobel

FINANCE COMMITTEE
Morgan Hebard
Chairman
Philip Laurent
W. J. Coxey

PUBLICATION COMMITTEE
James A. G. Rehn
Chairman
P. P. Calvert
Morgan Hebard
E. T. Cresson, Jr.
Editor

LIBRARY COMMITTEE
Frank M. Jones
Chairman
R. G. Schmieder
Henry Fox

Meetings held on the fourth Thursday of January, February, March, April, May, September, and October; and on third Thursday of November and December. The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Acadamy of Natural Sciences of Philadelphia.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of The Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of The American Entomological Society, volumes I–IV, out of print and cannot be supplied; V—date, price on application. Published in annual volumes of quarterly parts. Subscription price $5.00 per volume.

The Practical Entomologist, volumes I-II, 1865-1867. Price, $4.00 for the two volumes.

Memoirs of The American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50; number 5, 1928, price $2.00.

Entomological News, volumes I-XXXIX; many out of print. Subscription price $3.00 per annual volume.

Various irregular, non-serial publications have been issued, which may be found in our price list under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
Academy of Natural Sciences,
Logan Square, Philadelphia, Pa.

CONTENTS

A Revision of the New World Species of Trielis, a Subgenus of Campsomeris (Hymenoptera: Scoliidae). By J. Chester Bradley 195
(Issued October 3, 1928)

A List of the Species and Descriptions of New Forms of the American Genus Zale, and a New Form of Safia (Lepidoptera: Noctuidae, Catocalinae). By Frank Haimbach) 215
(Issued October 3, 1928)

Studies in the Gryllidae of Panama (Orthoptera). By Morgan Hebard 233
(Issued November 12, 1928)

VOLUME LIV NUMBER 4

DECEMBER, 1928

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT

THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

1929 v.p. contents

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
R. C. Williams, Jr.

VICE-PRESIDENT
Philip Laurent

CORRESPONDING SECRETARY
James A. G. Rehn

RECORDING SECRETARY
R. J. Titherington

TREASURER
E. T. Cresson, Jr.

LIBRARIAN
E. T. Cresson, Jr.

CURATOR
Louise Knobel

FINANCE COMMITTEE
Morgan Hebard
Chairman
Philip Laurent
W. J. Coxey

PUBLICATION COMMITTEE
James A. G. Rehn
Chairman
P. P. Calvert
Morgan Hebard
E. T. Cresson, Jr.
Editor

LIBRARY COMMITTEE
Frank M. Jones
Chairman
R. G. Schmieder
Henry Fox

Meetings held on the fourth Thursday of January, February, March, April, May, September, and October; and on third Thursday of November and December. The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Acadamy of Natural Sciences of Philadelphia.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of The Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of The American Entomological Society, volumes I IV, out of print and cannot be supplied; V—date, price on application. Published in annual volumes of quarterly parts. Subscription price $5.00 per volume.

The Practical Entomologist, volumes I-II, 1865-1867. Price, $4.00 for the two volumes.

Memoirs of The American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50; number 5, 1928, price $2.00.

Entomological News, volumes I-XXXIX; many out of print. Subscription price $3.00 per annual volume.

Various irregular, non-serial publications have been issued, which may be found in our price list under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
Academy of Natural Sciences,
Logan Square, Philadelphia, Pa.

CONTENTS

A Morphological and Systematical Study of Utah Asilidae (Diptera). By Claudeous J. D. Brown 295
(Issued February 13, 1929)

Sex Anomalies in the Genus Megachile, with Descriptions of New Species (Hymenoptera: Megachilidae). By Theodore Bertis Mitchell 321
(Issued March 1, 1929)